REPORT RESUMES

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STUDIES OF THE EFFECTS OF SYSTEMATIC VARIATIONS OF CERTAIN CONDITIONS RELATED TO LEARNING. I. CONDITIONS OF REINFORCEMENT.
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IN THIS INVESTIGATION, AN ATTEMPT WAS MADE TO EVALUATE THE EFFECT OF SYSTEMATIC VARIATIONS OF SELECTED CONDITIONS OF REINFORCEMENT. EMPLOYED AS SUBJECTS WERE THREE GROUPS OF CHILDREN (MENTALLY HANDICAPPED, INTELLECTUALLY NORMAL, AND INTELLECTUALLY SUPERIOR), ALL OF WHOM HAVE MENTAL AGES (REVISED STANFORD-BINET, FORM L) WITHIN THE 9 TO 12-YEAR RANGE. EIGHT TASKS WERE INDIVIDUALLY ADMINISTERED TO THE SUBJECTS. THESE INCLUDED A VERBAL AND A CONCRETE FORM OF TASKS ASSUMED TO INVOLVE CONDITIONED RESPONSE LEARNING, DISCRIMINATION LEARNING, RATE LEARNING, AND PROBLEM SOLVING. THE PROPOSED CONDITIONS OF REINFORCEMENT WERE DEFINED AS TYPE OF REINFORCEMENT, FREQUENCY OF REINFORCEMENT, AND TIME OF INTRODUCTION OF REINFORCEMENT. THE DIMENSIONS OR VARIATIONS OF THESE CONDITIONS OVERLAPPED. THE ANALYSES OF THE DATA INVOLVED COMPARISONS BOTH WITHIN INTELLIGENCE GROUPS AND BETWEEN INTELLIGENCE GROUPS. A NUMBER OF RELATIONSHIPS PERTAINING TO LEARNING PERFORMANCE AND LEVEL OF ASPIRATION WERE REPORTED. (LP)

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STUDIES OF THE EFFECTS OF SYSTEMATIC VARIATIONS OF CERTAIN CONDITIONS RELATED TO LEARNING.

I. CONDITIONS OF REINFORCEMENT

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June 1, 1958--September 30, 1959

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of Health, Education, and Welfare,
Office of Education

1959

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In Memoriam

Ernest L. Aspinwall

PREFACE

The investigation reported herein was performed at Syracuse University as a cooperative research project between the Syracuse University Research Institute and the United States Department of Health, Education, and Welfare, Office of Education pursuant to Contract SAE--7794. Most of the final report was prepared by the project director after she joined the faculty of the University of Georgia.

Funds have been granted for additional research related to the problems considered in this investigation. This research project, "Studies of the Effects of Systematic Variations of Certain Conditions Related to Learning. I. Conditions of Reinforcement--An Extension," is being conducted under the auspices cited above (Contract SAE 8742); Dr. Matthew J. Trippe of Syracuse University is the project director. The plan for the work involves employing the procedures described herein with a group of intellectually retarded subjects who are placed in residential schools, combining the data obtained in both investigations, and repeating the analyses with this new set of combined data. Until these new analyses are performed and the results are organized, interpreted, and reported, any use or citation of the data contained in the present report pertinent to the results of the current study probably should be limited.

ACKNOWLEDGMENTS

This investigation has been quite extensive and it is a pleasure to acknowledge the valuable contributions of the many people without whose cooperation and assistance the work never could have been completed. Sincerest appreciation and gratitude are extended to those named below; they graciously gave time, advice, and, in some cases, long hours of hard, painstaking labor often under rather difficult conditions.

Four people had an important, indirect effect upon this research through their influence upon the project director. Mrs. Thelma Godfrey first pointed out to her that perhaps intellectually retarded and normal children who have similar mental ages might be expected to respond differently in some situations. As a result of reviewing research related to the learning characteristics of intellectually retarded children, as a part of a course in the nature and needs of retarded children taught by Dr. G. Orville Johnson, she first became cognizant of the need for more work related to this topic. Gentle intellectual guidance and prodding by Dr. Francis J. Di Vesta greatly fostered her insight into and development of the rationale, basic design,, and methodology used in this and related investigations. Dr. William M. Cruickshank encouraged her to design the present investigation and to carry it through; and, highly essential, for several years he made it administratively possible for her to develop and realize her research interests.

The people whose names appear on the title page participated in many stages of planning and executing the study. Special recognition is due Edward T. Donlon. In addition to his other duties, Mr. Donlon generously volunteered to assume the extra responsibility for the highly intricate task of arranging for and scheduling the many investigator-subject sessions and for the organization of the subjects' records; also, he participated at all stages in the statistical analyses of the results and the final preparation of the manuscript. Dr. Beaber, Mr. Donlon, and Mrs. Woolfolk administered the intelligence tests; Dr. Shotick and Mr. Turansky developed and pilot tested the experimental tasks. During the final phase of the study,

these five people, Mrs. Heizman, and Dr. Blodgett administered the experimental tasks. In addition, Dr. Shotick supervised the scoring and final collation of the score sheets, and Mr. Turansky took responsibility for obtaining and preparing supplies. At various times during the study, five other people assisted in the data gathering process; they were Mr. William G. Arranga and Mr. Leonard W. Becker who administered intelligence tests and Mrs. Virginia R. Hickernell, Mr. Eric. F. Theiner, and Mr. Lawrence H. Weiner who administered experimental tasks.

The pilot testing, intelligence testing, and task administration required a large number of subject contacts. These subjects attended different public schools. Listed in Appendix A are the names of the cooperating public school personnel who kindly granted permission for the research to be conducted with the children under their jurisdiction and who directly assisted by making arrangements for testing facilities and subject scheduling.

Members of the staff of the Syracuse University Computing Center, under the general supervision of Dr. Bruce Gilchrist, former director, and Dr. Werner G. Rheinbolt, present director, took responsibility for the machine processing of the data. Mr. Richard D. Wilkins immediately supervised all of this work, developed the machine programs for the major statistical analyses, and conducted these analyses. Mrs. Virginia M. Sheehan and Miss Phyllis F. Gorlick performed the key punch operations.

Personnel of the Office of Research in Special Education and Rehabilitation at Syracuse University were most helpful. Dr. Matthew J. Trippe facilitated many administrative and budgetary arrangements. Miss June Nassif, Mrs. Jane Berry, Miss Ruth Frey, and Miss Deanna Tooley kept financial records and performed many of the clerical duties associated with a study such as this.

Miss Setsuko Koga very carefully translated research reports published in Japanese. Mrs. Jean Gilman and Mrs. Dorothy Farrell prepared the final manuscript for duplication.

The above named people were from Syracuse University or the Syracuse area. Nine people at the University of Georgia also contributed to the project. Mrs. Sara W. Fabian was responsible for the clerical work related to the completion of the several rough drafts of the research report. Miss Elizabeth C. Aderhold, Mr. Jerry C. Allen, and Miss K. Elizabeth White performed a large number of statistical analyses. Miss Mary E.

Hiott, Mrs. Charlotte L. Williams, Mrs. Hollis S. Barnes, Mrs. Rebecca S. Dover, and Mr. James D. Blake were most helpful in the arduous task of proofreading.

While the people named above made invaluable contributions to the improvement of and the completion of the research, the project director alone bears the entire responsibility for all errors and inadequacies in planning, execution, interpretation, and reporting.

* *

To the memory of the project director's father this work is dedicated with devotion and respect. It is impossible to convey in such limited space the depth of this man's insight, compassion, and patience; his active interest in and concern for others involved many facets, including problems of exceptional children. He especially was aware of the importance of motivation and he maintained close contact with the research reported herein from the time of the initial awarding of the contract until his sudden death during the last days before the completion of the final report. He is sorely missed and he will remain an inspiration and example to those who knew him.

K. A. B.

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CHAPTER I

STATEMENT OF THE PROBLEM

Introduction

A succinct general statement of one role of education is contained in the following quotation:

> But though the educational patterns [for individuals of different capacities] may differ, the goals remain much the same for all: enabling each young person to go as far as his aptitude will permit in fundamental knowledge and skills and motivating him to continue his self-development to the full along similar lines (79, p. 32).

However, there is evidence that in several aspects of academic performance intellectually retarded individuals do not achieve at a level commensurate with their mental age expectancy (19, 26). Neither do many intellectually normal and superior children (72, 39, 101). If it be a function of education to select experiences participation in which will enable the individual to develop to the fullest of the potentiality defined by his capacity, and, if there is evidence that some individuals are achieving below the expectations indicated by their assessed capacity, then there would seem to be a need for scrutiny of some of the bases of these observed discrepancies between achievement and expected potentialities. It would be pertinent to examine a number of facets of the educational process. Educational methodology is one such facet.

Educational methods are predicated upon the manner in which individuals learn. As a result, the development and effective use of these methods are contingent upon the response of the individuals in question to the conditions of which learning is a function. Important among these are task conditions and conditions of reinforcement.[1]

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[1] Actually, three logically separate but highly interrelated phenomena are involved in this latter topic. Respectively, these may be termed motive, incentive, and reinforcement. For the purposes of this investigation, McGeoch and Irion's definitions of motive and incentive were accepted; viz, ". . . a motive or motivating condition is any condition of the individual which initiates and sustains his behavior, orients him toward the practice of a given task, and which defines the adequacy of his activities and the completion of the task" (69, p. 194). "An object or condition which is reacted to as satisfying or potentially satisfying to a motive is called an incentive" (69, p. 195). Also accepted was Underwood's trenchant definition of reinforcement, "the receipt of an incentive" (104, p. 634), which was regarded as a satisfactory abstract of more detailed descriptions of what constitutes a reinforcing state of affairs. Motivation was considered to be an intervening variable about which inferences are made. Consequently, the immediate, practical focus herein was upon the

Questions related to the influence of task conditions in learning performance are important ones. In general practice, writers in the area of educational methodology have suggested that expectations about an individual's performance on intellectual tasks can be based upon his level of mental maturity (46, 73, 57, 38). Mental age is a frequently employed index of level of mental maturity. The generality of this practice as it relates to individuals of different levels of intelligence has been challenged (40, 20, 53). Individuals who have similar mental ages but different levels of intelligence differ in terms of what may be termed behaviorally as "brightness," chronological age, and experiential backgrounds. To some extent, the subtest successes which are summed to obtain the total mental age differ for intellectually dissimilar individuals. It would follow, then, that these individuals, even though equivalent in over-all mental age, might differ in response to related intellectual tasks. As a result, the question becomes: Can expectations about intellectual performance be based upon mental age alone, or are they contingent upon a consideration of mental age in relationship to chronological age, intelligence quotient, the characteristics of the task, and the aspect of performance being considered?[1] Therefore, information about the influence of task variables is highly important to those who seek to select and employ methods by which intellectually retarded, normal, and superior individuals can be educated most effectively.

Motivation--and thus the related incentive-reinforcement conditions--is recognized to be central in learning and achievement. As Woodworth and Schlossberg have stated:

> It is recognized in everyday life that a person's performance does not always measure up to his ability. He does not run as fast or shoot as accurately or speak as convincingly as he has on other occasions. He is perhaps not highly motivated, or he may even be overmotivated and so eager to succeed as to lose control of his resources of energy and skill. Both ability and motivation are factors in performance and if either of them is entirely lacking, the performance does not occur. Ability is like a machine which cannot do its work unless power is applied (108, p. 655).

A similar point of view is reflected in the statement that "Excellent performance is a blend of talent and motive, of ability

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effects of incentives upon the subject's responses, or (later in the time sequence)the effect upon the subject's responses of receiving (i.e., having administered to him) the incentive; that is to say, the effect on the subject's responses of receiving reinforcement through being administered the incentive. Perhaps, the most complete term for the situations to be discussed would be motive-incentive-reinforcement conditions; nevertheless, for convenience and to preclude awkwardness in phrasing, this term will be abbreviated to reinforcement conditions as often as possible.

[1] For a more complete discussion of this issue refer to Johnson and Blake (53).

fused with zeal. Aptitude without aspiration is lifeless and inert" (79, p. 45).

The validity of these comments is vouchsafed by the observation that one of the major differences between achieving and underachieving intellectually gifted individuals may be classified as motivational (39, 101). Furthermore, there is reason to believe that intellectually retarded individuals, who often encounter failure in dealing with educational tasks, may have difficulties in the motivational and emotional areas and that these, in turn, may affect the adequacy of their intellectual functioning (7, 11, 82). So, information about motive-incentive-reinforcement conditions is essential to those who attempt to plan and utilize methods by which intellectually retarded, normal, and superior individuals can be educated most effectively. A number of aspects of the topic are relevant. Several of these are well illustrated in the following comments by Cronbach.

> Teachers are properly concerned with motivation. Their question, 'How can we motivate pupils' becomes, upon examination, a series of other questions. 'What sort of goals do pupils work toward?' 'What causes a pupil to select one goal rather than another?' 'How can teacher influence pupils to choose appropriate goals?' These questions all deal with the formation of purposes. A second series of questions deals with consequences: 'Which is more effective, reward or punishment?' 'Should competition be used to motivate pupils?' and so on (18, p. 413).

Briefly, these questions might be summarized as follows:

1. What reinforcement conditions are conducive to the setting of appropriate and/or attainable goals?
2. What reinforcement conditions are conducive to the most adequate task performance?
3. Are the effect of reinforcement conditions on goal setting and task performance influenced by subject variables and task variables?

It will be remembered that a question was posed about the role of task variables in the relative intellectual performance (with incentive conditions held constant) of individuals who are similar in terms of mental age but different in terms of intelligence level and thus chronological age. An attempt was made in this investigation to obtain information pertinent to this question and the three stated immediately above.

Review of the Literature

The literature considered most pertinent to the problem are those studies in which individuals below college age[1] were used as subjects in investigations in the two major areas discussed. These include:

1. relative performance of subjects who have similar mental age but different intelligence quotients on intellectual tasks--psychometric scales, achievement tests, and learning tasks; and
2. response of subjects to reinforcement conditions--material reward, praise and reproof, competition, success and failure, and level of aspiration.

Relative Performance

An extensive and current review of the literature pertinent to this topic has been presented by Johnson and Blake (53). No attempt will be made in this section to restate this more detailed work, rather, the results of the investigations cited by these authors will be listed in the summary of the literature.

Reinforcement Conditions

Material Reward

The efficacy of material rewards as reinforcement for school children has been the topic of four investigations.

Thorndike and Forlano (100), Thorndike (99), Forlano (31), and Abel (1), all observed that subjects who worked for material rewards performed more adequately than did subjects who received knowledge of results, verbal rewards, or no rewards. In addition, Thorndike and Forlano (100) found that, to a certain extent, subjects made increasingly higher scores upon a verbal choice task as they were promised increasingly higher rewards--one tenth cent, two tenths cent, four tenths cent, and eight tenths cent. The score increments were apparent through the reward series to four tenths cent; there was no difference between the scores the subjects earned in the four tenth cent and eight tenth cent conditions. The results of a subsequent Thorndike (99) study indicated that these results did not obtain when different subjects were employed in the amount of incentive conditions, or when the same subjects were used but the several incentive conditions were administered during different experimental sessions rather than during one session. Forlano (31) was interested in the influence of delayed and immediate knowledge of results and actual and promised rewards upon the subjects' learning and retention of spelling and arithmetic materials. In general, delayed knowledge of results was more effective than immediate, promised and actual reward were more effective than no reward, and promised and actual reward were equally effective.

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[1] It is recognized that the separation of studies in which children were employed as subjects from those in which adults and infrahuman subjects were used is an artificial one. Many generalizations pertinent to the chosen topics emanating from these latter studies may be applicable to the behavior of children; nevertheless, space limitations preclude the treatment of these investigations herein. Extensive reviews of the omitted research have been published (34, 52, 60, 62, 69, 70, 75, 78, 87, 108).

Using the Warden U-Maze, Finger Type, as the task, Abel (1) observed that material reward (one cent) was more effective than verbal reward or no reward. This was the case whether the material reward was administered after every trial from the beginning of a thirty-trial sequence or after each of the latter 15 trials. Also, material reward administered during the last 15 trials and material reward administered during the total 30 trials were equally effective. She obtained similar results in a subsequent investigation in which she employed subjects who had different levels of intelligence, and in which she made administration of reward contingent upon adequacy of performance. In the latter study, she also added a maximum material reward (25 cents) condition. While subjects receiving this incentive scored higher than did whose to whom the material reward (one cent) was administered, the difference between the performance scores of the two groups was not significant.

Praise and Reproof

The relative usefulness of praise and reproof as reinforcement when administered to groups of children has been studied extensively. The following list includes investigators in this area and the tasks they employed: Gilchrist (37), Courtis English Test 4B; Hurlock (47), National Intelligence Tests and Otis Intelligence Scale, Primary Examination; Hurlock (48), Courtis Research Test--Arithmetic; Brenner (9), word learning; Benton (6), Otis Intelligence Scale, Intermediate Examination; Forlano and Axelrod (32) cancellation; Schmidt (83), digit symbol substitution; Thompson and Hunnicut (98), cancellation; and Grace (43), punchboard maze modification of the Peterson Rational Learning Task. Most of these investigators reported that subjects who received praise and reproof exceeded the performance of control subjects who received no reinforcement information, and that praised and reproved subjects did not differ significantly in performance. Furthermore, Hurlock (48) noted that ignored subjects who were in the same room with praised and reproved subjects, while exceeded by these latter subjects, scored higher than control subjects in another room who only repeated the tasks and heard no incentive comments. There were several exceptions to the above results. Brenner (9) and Schmidt (83) found no significant differences among praised, reproved, and control subjects. Forlano and Axelrod (32) stated that reproved subjects tended to score higher than praised and control subjects.

In addition to the above cited results, a number of these investigators reported further analyses which were conducted for the purpose of examining variables which might have been influential in the observed relationships. The variables studied included persistence of the observed relationships, chronological age, level of intelligence, academic achievement, investigators, time of administration of reinforcement, and personality.

Evidence about the persistence of the observed relationships over a number of trials is contained in the studies by Hurlock (48), Schmidt (83), Brenner (9), Grace (43), and Forlano and Axelrod (32). In the Hurlock (48) study, the tasks or trials were administered during separate daily sessions, in the latter studies, all of the trials were administered during one session. Hurlock noted that although praised and reproved subjects showed equivalent initial increments in performance, during three subsequent days of reinforcement administration, praised subjects continued to improve, while reproved subjects showed a performance decrement. Also showing decrements were ignored and control subjects. However, reproved subjects continued to perform more adequately than ignored subjects who, in turn, continued to exceed control subjects. On the other hand, Forlano and Axelrod reported that reproved subjects who scored higher than praised and control subjects initially continued to do so in a subsequent trial. The superiority of Grace's (43) praised and reproved subjects over her control subjects on an initial trial diminished to non-significance during two subsequent trials. While Schmidt's (83) and Brenner's (9) praised, reproved, and control subjects did not differ in performance, all did show initial performance gains which were followed by decrements; in the Schmidt study, this decrement was not apparent until the final trial which, interestingly enough, was the one in which he promised one dollar to the subject making the highest score.

Hurlock (47) and Schmidt (83) evaluated the age variable by comparing the performance of the different reinforcement groups at several grade levels. Hurlock reported that in grades 3, 5, and 8 praised and reproved subjects did not differ in the performance but both groups exceeded control subjects. Schmidt studied subjects in grade 7, grade 8, high school, and college. He noted some tendencies for a differential response to the reinforcement at the several grade levels; however, there was no consistency in these results for two administrators or investigators.

These two investigators also looked for sex differences in response to incentives. Again, Hurlock (47) found that the over-all relationships observed for the total group were evident in the performance of the boys and the girls separately; *i.e.*, praised and reproved subjects did not differ in performance but both groups exceeded control subjects. However, when she compared boys and girls within the several incentive groups, she noted that although control girls made greater test-retest gains than control boys, praised and reproved boys exceeded praised and reproved girls. Schmidt (83) obtained no consistent significant differences when he compared boys and girls in terms of performance in the several incentive groups.

Hurlock (47) also scrutinized the intelligence and academic achievement variables. She divided her subjects into three intelligence groups. The mean (rounded) intelligence quotients of these groups were the following: superior, 121; average, 100; and inferior, 78. Within each intelligence group, the praised and reproved subjects showed equivalent gains while both groups exceeded control subjects. She further compared the intelligence groups within each reinforcement group. Here, inferior control subjects exceeded superior control subjects. With practice effects removed, within both the praised and reproved groups, superior subjects exceeded inferior subjects. She presented no comparisons of the performance of superior and average subjects and of average and inferior subjects. However, examination of the total table of results revealed the following: within the praised and control groups, average and superior subjects showed similar gains while inferior subjects exceeded average subjects; within the reproved group, average subjects exceeded both superior and inferior subjects. Since Hurlock cited significance data for the former comparisons, but not for those just described, it would seem safe to infer that no significant differences occurred in the latter cases. When comparisons were made of the performance of groups of subjects classified as superior, average, and inferior on the basis of teacher ratings of their academic work, the results were similar to those cited above in reference to the comparisons of intelligence groups.

The consistency of the results obtained when different people administered the reinforcement conditions was a factor specifically investigated by Schmidt (83). In the course of a large number of analyses, he found some comparisons in which statistical significance was reached; nevertheless, he reported no over-all, consistent, statistically significant differences between the effects of the several types of reinforcement which could be considered to be a function of differences between administrators.

Brenner (9) sought to evaluate the role of the time dimension in the influence of reinforcement upon learning and recall. He employed six groups--immediate (after 2 minutes) and delayed (after 1 day) praised and reproved groups and two control groups. The obtained performance data indicated that the six groups of subjects did not differ significantly in terms of either learning or recall.

Three investigators examined the role of personality variables in the response of subjects to praise and reproof. Thompson and Hunnicutt (98) observed that introverts performed more efficiently on a cancellation task following praise; whereas, extroverts performed more adequately following reproof. On the other hand, Forlano and Axelrod (32) reported that both reproved and introverts and extroverts performed a cancellation task more adequately than their praised counterparts.

Grace (43) assessed personality characteristics by means of three standardized devices--the Rogers Test of Personality Adjustment, the Pintner Aspects of Personality, and the Pintner Pupil Portraits. Her data sustained no relationships between assessments of personality thus obtained and response to praise and reproof.

Competition

The investigations in which competition was evaluated as reinforcement for children may be classified into four categories: studies in which the subject competed with himself in the sense of attempting to exceed his own past performance; studies in which the subject competed with a group or with other subjects; studies in which two groups of subjects competed with each other; and studies in which a comparison was made of a subject's performance when he competed with other individuals and when he competed as part of a group against another group. In all of the studies to be cited, subjects performed in a group, that is, in the presence of other subjects.

Brown (10) and Kirby (56) studied self-competition in relation to arithmetic performance. Kirby announced daily scores, Brown had the subjects prepare daily performance graphs; both emphasized that each subject should work to exceed his own past scores and that judgments were being made of individual improvement rather than of relative status within the group. Both investigators observed that subjects performing under conditions of self-competition tended to obtain slightly higher scores than control subjects.

The next category of studies includes those in which an attempt was made to determine whether a subject's performance was affected by competition with a group or other individuals. Contained in the following list are the investigators of this topic and the tasks they employed: Triplett (102), rotating reels to move a flag; Chapman and Feder (15), number cancellation and digit symbol substitution; de Weerdt (23), digit symbol substitution and Thorndike arithmetic sheets; the Chapman and Cook speed test in reading, cancellation, multiplication, same-opposites, and multiplication by substitution; Symonds and Chase (94), Charters Diagnostic Language Test; Panlasigui and Knight (77), arithmetic; Leuba (61), multiplication; Maller and Zubin (66), National Intelligence Tests; Zubin (109), addition and comparison of numbers. Generally, these investigators reported, first, that subjects performed more adequately on the several tasks when they competed with other subjects or a group than they performed when they did not compete, or, second, that subjects who competed performed more adequately than control subjects who were not exposed to the competition incentive.

In order to determine the effect of group competition on performance, Hurlock (50) compared the scores obtained by a control group who repeated the Courtis Research Test in Arithmetic over a five-day period with those obtained by groups who competed with each other daily for higher scores. The competition groups increased daily in accuracy and number of problems worked; the control group decreased.

Whether subjects performed more adequately when they were working for themselves against other subjects or when they were working for a group against another group was the issue investigated by Maller (65), Forlano (30), and Sorokin, Tanquist, Parten and Zimmerman (90). Maller observed that when subjects worked for themselves they made higher scores on an addition task than they did when they were working for a group; they also performed better than control subjects who received no competition set. Sorokin and his associates obtained similar results when they obtained performance measures on a series of motor tasks. On the other hand, Forlano failed to find significant differences between the cancellation performance of subjects when they worked for themselves and when they worked for several groups against other groups.

Success and Failure

There have been a number of investigations of the influence of interpolated success or failure on the responses of children. Researchers in this area have utilized as dependent variables the resumption of activities, preference for or attractiveness of goal objects, persistence, and performance on motor and verbal tasks.

Studying the effect of success and failure on task resumption, Rosenzweig (80) noted that a majority of his physically limited subjects said they liked a puzzle they were allowed to complete better than one they were not allowed to complete. However, when they were asked to choose a puzzle to repeat, about half selected the completed puzzle and about half the uncompleted one. Examining the chronological age variable, he found that the youngest subjects most often wished to repeat the completed puzzle, while the oldest subjects tended to choose the uncompleted one. An approximately equal number of intermediate age subjects chose each puzzle. Subjects who chose to repeat the uncompleted puzzle tended to rank higher in terms of teachers' ratings of the characteristic, pride or desire to excell. Sanford (81) replicated this study with slightly older, non-physically limited children employed as subjects. His results were, in general, consistent with those obtained by Rosenzweig.

Filler (28) sought to evaluate a number of variables affecting ratings of the attractiveness of goal objects. The subjects ranked nine toys in terms of attractiveness; the fifth became the goal object which could be attained by successful performance of a pegboard game. The attainment (task soluble) and non-attainment (task insoluble) groups were each divided into four subgroups who received different expectation and merit sets: expectation--easy task, non-expectation--very difficult task; merit--task success depended upon ability, non-merit--task success depended upon chance factors. After the subjects performed the pegboard task under these conditions, they again ranked the toys according to their attractiveness. After attainment, the subjects ranked the goal object higher in terms of attractiveness; after non-attainment, lower. The subjects in the two expectation and the two merit conditions did not differ in terms of changes in their rankings of the goal object attractiveness. Following both attainment and non-attainment, the critical goal objects were significantly more attractive for girls than for boys. For well-adjusted subjects (California Test of Personality, Primary Series), there was a significant increase in the attractiveness of the goal object after attainment and a significant decrease after non-attainment; for the poorly adjusted subjects, there was no significant change in the ratings of goal object attractiveness following either attainment or non-attainment.

The role of ego involvement in the tendency to resume interrupted tasks was examined by Uematsu (103). Subjects were interrupted as they performed the Kraeplin test (adding columns of inverted numbers) in the presence of the investigator; this was designated the ego involving situation. In another situation, the subjects were interrupted while they were performing the task in the absence of the investigator; this was considered the non-ego involving situation. The subjects did not differ in terms of tendency to resume the task in the two situations. However, when subjects who had experienced success in attaining goals set as levels of aspiration for the task were compared with subjects who had experienced failure, a significant difference was apparent. The successful subjects tended more often to resume the task. There was no significant relationship between tendency to resume the task and intelligence level.

Grosslight and Child (44), in a study of persistence, examined the effect of intermittent task induced failure followed by success on the responses of intellectually retarded subjects when they encountered a final insoluble task. The subjects who had experienced no previous failure ceased their attempts at solution quickly when confronted with the final failure condition. Conversely, subjects who had experienced previous failures (on one trial, and on two trials) and subsequent success required more trials to reach extinction and made more frequent and varied attempts at substitute solutions. There were no significant differences in these respects between the latter two groups of subjects who had encountered different amounts of previous failure.

The largest number of the investigations in this area have been devoted to the study of the relationship between success and failure and the adequacy of task performance. In an early study, Goodenough and Brian (41) noted that overthrow errors in ring tossing performance occurred much more often after successful throws than after unsuccessful ones. Fitzgerald (29) reported that both physically limited and non-physically limited subjects showed increased variability on the Kent-Shakow Form Board after false failure scores; however, there was no difference between the mean scores made by the groups on the pre-failure and post failure tasks. As a group, subjects to whom Osler (76) gave interpolated failure information completed less long division problems on a final examination than they did on an initial examination. Analyses of individual responses revealed results ranging from improvement to impairment in performance. Sherman and Bell (88) investigated the effect of success and failure on memory for previously incidentally learned words which were randomly arranged in a longer series of words. A comparison of mean errors yielded no significant differences. Establishing a base line by means of a modified version of the Form L of the Revised Stanford-Binet Test of Intelligence, Lantz (58) observed that subjects showed a significant decrease in performance on comprehension, word naming, and rhyme subtests and a decrement approaching significance on verbal absurdities and digit repetition subtests of the Form M of the test following failure on a task called Ball Game (modified Dembo-Brown technique). There was no evident change in performance following success. In summary, she stated that while reasoning and thinking subtests showed a decrement after failure, there was no effect on subtests requiring visual or rote memory.

Several investigators have attempted to analyze variables related to performance after success and failure information has been administered. Sullivan (93) was interested in the intelligence variable. The mean intelligence quotients (rounded) of her respective groups were 100, 79, and 70. Each of these groups was divided into control, success, and failure subgroups. The experimental procedure involved the interpolation of success or failure information between the subjects' attempts to memorize two lists of nonsense syllables; control subjects received no verbal reinforcement. The number of trials in which the three control subgroups learned the two lists did not differ significantly. Following success information, the number of trials necessary for the subjects who had a mean intelligence quotient of 100 to learn a second list did not differ significantly from the number of trials they utilized to learn the first list; this was also the case for subjects who had a mean intelligence quotient of 70. However, subjects who had a mean intelligence quotient of 79 required significantly less trials to learn the second list. Following failure information, the subjects in all three intelligence groups needed more trials to learn the second list.

Gaundine-Staunton (35) studied low achieving subjects and high achieving subjects. These subjects had achievement test scores which were respectively a standard score of one above or below their intelligence test scores. Her task was one trial of a finger maze which no subject completed successfully and the pertinent response measures were the distances traveled during the first and last half minutes of the task. She noted that low achievers tended to show relative increases in the distance traveled during the last half minute while high achievers showed relative decreases.

Attempts also have been made to determine whether personality variables may be related to individual differences in response to success and failure information. Although they do not report how ascendance and submission were assessed, Taylor and Farber (96) found that after failure the performance of submissive subjects on the Kent-Shakow Form Boards was significantly inferior to that of ascendant subjects. Sherman and Bell (88) reported that it would be possible to classify under the heading of submissive behavior the five traits which characterized subjects who showed the most performance decrement in word memory after failure in contrast to the traits of those subjects who showed the least performance decrement. Sherman and Jost (89) employed subjects from a private school who were judged to be well adjusted and subjects from an orthogenic school who were considered to be extremely maladjusted. The subjects were given success and failure experiences in the learning of digit sequences. A number of physiological measures were taken during the learning periods, during rest periods, and while the subjects received sensory stimulation. In general, the maladjusted subjects showed more evidences of physiological disturbances than did well adjusted subjects during all of the activities. The results related to success and failure were not stated clearly. Hutt (51) investigated the influence of success and failure on subjects' responses to the Stanford-Binet Test of Intelligence. He used both the standard and the adaptive (difficult items followed by items on which success was probable) methods of administration with groups of children rated as well adjusted or maladjusted. The maladjusted subjects attained higher mental ages when the adaptive rather than the standard menthod was employed. On the other hand, the well adjusted subjects did not differ in mental age attained during the two procedures.

Chase (16), Anderson and Smith (5), and Anderson (3) studied the influence of multiple incentives--success and failure, praise and reproof, and reward (gold star) and punishment (buttons cut off of paper cut-out) on dynamometer performance. Originally, Chase found that control subjects performed significantly less well than did subjects to whom were administered the success, success-praise, and success-reward conditions. There was no difference among the performance of the groups of subjects who received these latter three types of reinforcement. Similarly, the control group of subjects performed less well than did groups of subjects who received the failure, failure-reproof, and failure-punishment types of reinforcement. Again, the latter three groups did not differ in performance as they received the three types of reinforcement.

In addition, the subjects performed reliably better when they received failure, failure-reproof, and failure-punishment than they did when they were administered success, success-praise, and success-reward. Chase suggested that these latter results may have been a function of the subjects having had previous success with the investigator and/or a higher subject interest in the train system than the water system (connected with the dynamometer). Three years later in a replication of the Chase study with these subjects, Anderson and Smith obtained generally the same results.

Anderson further analyzed the Chase and the Anderson-Smith data to determine the effect of age and to scrutinize further the performance of the subjects after success and failure. He observed that when the subjects received the failure conditions, their scores showed a marked decrement; on the other hand, when they received the success conditions, their scores tended to remain the same or show only a slight decrement. The precipitate score decrement after failure was accentuated when the subjects were older. Anderson also employed additional subjects and reversed the original order in which the success-praise and failure-reproof conditions were administered; that is, he administered the failure-reproof condition before the success-praise condition. The subjects performed better when they received the success condition than they did when they received the failure condition. On this basis, Anderson concluded that whether the two be success or failure, children perform better during the second exposure to an incentive than they do during the first.

Level of Aspiration

Highly related to the preceding investigations in which motivation either was assumed or in which attempts were made to elicit motivational tendencies is the research related to the explicit goal setting process or level of aspiration. An examination of the literature revealed only one investigation in which the task performance of subjects when they set levels of aspiration was compared to the task performance of control subjects. This investigation was conducted by Anderson and Brandt (4) who compared the Woodworth-Wells Cancellation Test performance of experimental subjects who set goals and received performance information with that of control subjects who did not set goals and who did not receive performance information. The total scores of the experimental subjects on six cancellation trials were significantly higher than those of the control subjects. The groups were equivalent in terms of mean performance on the first trial. In the experimental group, the difference between the initial score and the mean of the scores on the latter trials was highly significant. The corresponding difference for the control subjects was not significant.

Most of the work in the level of aspiration area has been directed toward the evaluation of procedural variables and attempts to define determinants of goal setting responses. These latter studies are pertinent at this point. Variables most often scrutinized have been success and failure occurring during a sequence of trials or tasks, academic achievement, age, and personality.

Jucknat's (55) extensive investigation constitutes the pioneer research on the effect of success and failure on the levels of aspiration of children. One facet of her work involved the effect of success and failure during a series of tasks upon the goals the subjects set within that series. She employed a series of ten soluble paper and pencil mazes and a series of ten insoluble ones. In the soluble series from the first to the last maze, the level of aspiration of the subjects was increased and the majority of shifts or changes in goals set were upward. Conversely, in the insoluble series, the level of aspiration was decreased and the majority of goal shifts were downward. When she further analyzed the data in terms of ratings or judgments of the intensity of the subjects' reactions to success or failure, she observed that the above trends were accentuated along the continuum of mild to strong reaction to attainment or non-attainment.

Anderson and Brandt (4) also were interested in the effect of adequacy of performance within a series of trials on level of aspiration. They graphed the relative status of subjects in terms of their performance on the Woodworth-Wells Cancellation Task. In addition, they gave each subject a card (designated Cancellation Progress Chart) which contained his own score, the average class score, and the relationship of his score to the average score of the class. After examining the information on his card and his anonymous relative position on the class graph, each subject set levels of aspiration for the succeeding trials. In the analyses of results, the subjects were divided into quartile groups on the basis of cancellation performance. Subjects in the highest quartile group set their goals below their own performance levels; nevertheless, these goals remained above the average performance score of the group. Subjects in the lowest quartile set goals above their performance level; these goals were comparable to the mean performance level of the class. The subjects in the two intermediate quartiles set goals slightly above and below their performance level on the several trials; nevertheless, in terms of mean responses, their levels of aspiration tended to be slightly above their own performance scores, which, of course, constituted the mean performance of the class.

A related study is Shaw and Bensberg's (86) investigation of the level of aspiration behavior of mentally deficient subjects after they experienced success and failure. The mean (rounded) chronological age of the subjects was 20 years. They were classified into four groups according to intelligence level. The mean (rounded) intelligence quotients of these four groups were 62, 55, 49, and 42. Each group was divided into subgroups of subjects who received success or failure information. Three tasks were utilized. After each of the ten trials of the first task, designated as the Ball-In-Hole Task, subjects in the respective subgroups were given the success or failure information. The second task, designated the Ball Through Hoop Task, was considered similar to the training task and the third task, Picture Identification, was considered dissimilar. These latter two tasks were presented to the subjects in counterbalanced order. On the first task, there was a significant difference between the mean levels of aspiration set by the success and failure subgroups. There were no significance data reported for a between intelligence group comparison; however, the success-failure x intelligence groups interaction was not significant. The highest possible score on a trial was 10. The success groups were told that they made scores of 7, 8, or 9 (distributed randomly, mean equaled 8) on the 10 trials, while the failure groups were told they made scores of 1, 2, or 3 (distributed randomly, mean equaled 2). It is interesting to note that the mean level of aspiration scores of the four success groups did not deviate one point from 8; two were a fraction above 8, two were a fraction below. In the four failure groups, the mean levels of aspiration were above 2. For the descending levels of intelligence, the deviations from two were .95, 1.95, 2.43, and 2.01. The authors reported no data pertinent to goal discrepancy scores or the significance thereof; however, inspection reveals that mean levels of aspiration were very similar to mean reported performance scores.

Shaw and Bensberg also were interested first, in the effect of success and failure during the initial task on the levels of aspiration set by the subjects for performance on the latter tasks which were designated as similar and dissimilar and second, in the extent to which such transfer was a function of degree of intellectual retardation. Analyses of the data yielded significant F ratios associated with variance between tasks, and between degrees of mental retardation. The tasks x degree groups interaction was not significant. However, the investigators commented that the greater the degree of mental retardation, the closer the correspondence between levels of aspiration set on the three tasks.

They presented no significance data pertinent to level of aspiration differences between success and failure groups on the latter two tasks. Inspection of the mean levels of aspiration on these tasks revealed that the success groups apparently tended to set levels of aspiration which were lower than those they set on the initial task; conversely, the failure subjects tended to set higher goals on the latter tasks.

In all comparisons the standard deviations were small and apparently fairly homogeneous. The authors reported no significant data pertinent to relationships between these.

One of the initial studies of the academic achievement variable was that by Jucknat (55). She utilized as her task a series of ten paper and pencil mazes arranged in ascending order of difficulty; she classified her subjects as consistently good, medium, or poor in their school work. When she compared the subjects on the basis of their initial levels of aspiration, she observed that the good students set goals in the high ranges of the 10-point scale; the medium achievers, in the middle ranges; and the poor achievers, in the lower ranges.

Sears (84), too, scrutinized the role of the previous school experience variable. Her timed reading (word meaning) and arithmetic tasks were closely related to the areas in which the subjects had experienced success and failure; she employed subjects who had been successful in all school experiences including reading and arithmetic, subjects who had been unsuccessful, and a differential group of subjects who had been successful in reading and unsuccessful in arithmetic. These three groups of subjects were exposed to a neutral condition in which they only set goals related to each task. Subsequently, each group was divided into two subgroups. One subgroup received success information related to reading and failure information related to arithmetic; the other subgroup received the reverse of this. In the success condition, success information was given to the subjects on 15 trials and mild failure information was given intermittently on 5 trials. In the failure condition, the opposite kind of information was given to the subjects on the corresponding trials.

In the neutral condition, the failure group had a significantly higher goal discrepancy score related to reading than did the success group. There was no significant difference between the goal discrepancy scores of these groups related to the arithmetic task; nor was there a significant difference between the goal discrepancy scores of the differential group and those of these two groups related to either the reading or the arithmetic task. In general, on both tasks the failure group was more variable in terms of the goal discrepancy scores than the other two groups and the differential group was more variable than the success group; however, no significance figures pertinent to these comparisons were reported.

Sears stated that, with two exceptions (not specified), when the subjects' performance in the success and failure conditions was compared to their performance in the neutral condition, there was an increase in the size of the mean goal discrepancy score and the variability of the goal discrepancy scores after failure and a decrease in these after success. She presented no significance figures pertinent to these comparisons. Nor did she report specific comparisons of the levels of aspiration responses of the success, failure, and differential groups as they performed the tasks in the success and failure conditions.

She compared the subjects in terms of what she designated as secondary measures of level of aspiration. These were the following: flexibility--percentage of times a subject changed his level of aspiration regardless of the direction; responsiveness--number of times the subject set his new goal in the direction corresponding to his immediately preceding performance change or status, upward, downward, or the same; negative discrepancy--number of times the subject set his level of aspiration equal to or below the level of his immediately preceding performance. The three groups did not differ significantly in terms of these three measures as they performed in the neutral, success, and failure conditions on the reading and arithmetic tasks.

Sears also categorized the subjects in the three groups in terms of three classes of goal discrepancy scores obtained in the neutral condition--low positive, middle positive, and high positive. In reference to responses to the reading task, she reported that in terms of the number of subjects in each category, the success and differential subjects did not differ while the failure subjects differed from both of these. The majority of the failure subjects were placed in the high positive category even though some were placed in the other categories; on the other hand, the majority of the success and differential subjects were placed in the middle positive category.

Sears commented that in the response to the arithmetic task the same results appeared with somewhat less statistical reliability. She presented no data pertinent to similar analyses of the subjects' responses as they performed in the success and failure conditions.

Sections of two further studies pertain to the relationships between academic achievement and level of aspiration. Walter and Marzolf (106) found no significant difference between the goal discrepancy measures of subjects who scored above the median on an academic achievement test and those who scored below the median. The levels of aspiration set by the subjects related to performance on the Rotter Aspiration Board. Similar results were obtained by Uematsu (103) whose subjects set levels of aspiration relevant to performance on the Kraepelin Test (adding columns of inverted single digits). Subjects categorized according to the size and direction of their goal discrepancy scores (large positive, small positive, small negative, and large negative) did not differ significantly in terms of mean academic achievement; neither did these groups differ in terms of mean intelligence. Uematsu also studied the level of aspiration responses of these subjects in situations designated as ego involving (investigator present) and non-ego involving (investigator absent). There was no significant differences between the subjects' goal discrepancy scores in these two situations.

Evidence about the role of the age variable may be found in several investigations. Generally, the results indicate that no relationships have been observed. Using soluble and insoluble mazes as tasks, Jucknat (55) observed no significant differences among the sizes or directions of changes in levels of aspirations set by adult and 11- and 12-year-old subjects. Walter and Marzolf (106) found no significant differences among the goal discrepancy scores of fourth, sixth, eighth and twelfth grade subjects as they set goals on the Rotter Aspiration Board. Similarly, Adams (2) noted no consistent differences among the percentage of times fourth and eighth grade pupils and college juniors shifted their levels of aspiration after success and failure in a dart throwing task.

Some investigators have hypothesized that personality characteristics have an important influence upon goal setting responses. Sears (85) utilized behavioral ratings in the study of children who showed characteristic patterns of level of aspiration behavior. Subjects in the category defined by low positive goal discrepancy scores were rated as high in self-confidence, satisfied with their achievement, and not threatened by failure in coping with difficult material. Subjects in the high positive goal discrepancy score category tended to be rated as low in self-confidence, dissatisfied with their achievement, and apprehensive when faced by difficult material. Subjects in the negative goal discrepancy score category were rated as high in self-consciousness, socially oriented, and self-defensive or self-protective in situations in which they had to deal with difficult material. When the subjects rated a number of activities in terms of wished for adequacy and perceived competence, the subjects in the high positive, low positive, and negative goal discrepancy score categories showed respectively the highest, next highest, and lowest deviations between these two ratings.

Little and Cohen (63) sought indirect evidence pertinent to the personality variable. Reasoning that high striving on the part of children and over-ambition in mothers possibly are related and result in tensions which may be manifested psychomatically in allergic symptons, they studied the level of aspiration responses of asthmatic children and the goals the childrens' mothers concomitantly stated that they expected them to make. Also employed were a group of control children and their mothers. The subjects set levels of aspiration related to dart throwing performance. In general, the asthmatic children set positive goals that were significantly higher than the positive goals set by the control children. The mothers of asthmatic subjects set high positive goals for their children while the mothers of the control subjects set low positive goals for theirs; the difference was significant. The goals which the mothers set for their asthmatic children did not differ significantly from the goals which the children set for themselves. On the other hand, mothers of the control children set goals for their children which were significantly lower than the goals the children set for themselves.

Uematsu (103) scrutinized the relationships among measures of adaptability and introversion-extroversion and level of aspiration responses. Subjects assigned to four goal discrepancy categories (high positive, low positive, low negative, high negative) did not differ in terms of ratings of adaptability or scores on the Tanaka test of introversion-extroversion.

Gardner (36) attempted to relate four observers' ratings of subjects in terms of several personality characteristics and the subjects' level of aspiration responses. Digit symbol substitution was the task. Subjects classified into high and low discrepancy score groups did not differ significantly in terms of any of the ratings.

Using the Rogers Test of Personality and teachers' ratings as reflectors of personality adjustment and a modified substitution task (in which subjects associated shorthand symbols and alphabetic characters) as the level of aspiration task, Gruen (45) looked for a possible covariance of adjustment status and a number of level of aspiration measures. Maladjusted subjects had both positive and negative goal discrepancy scores which cancelled out to slightly more than zero; adjusted subjects, only low positive goal discrepancy scores. Thus, the mean goal discrepancy score of the maladjusted subjects was significantly lower than that of the adjusted subjects. The two groups differed significantly in terms of variability of the goal discrepancy scores; the maladjusted subjects showed greater variability. The well adjusted subjects raised their goals after every success. The maladjusted subjects responded similarly after a number of successes; however, in some cases, they did not change or they lowered their goals. After a failure, the majority of the adjusted subjects lowered their goals while the majority of the maladjusted subjects did not change their goals. The author presented no significance figures pertinent to the latter information about goal shifts after success and failure.

Escalona (27) designated subjects as well adjusted or maladjusted on the basis of case histories and descriptive materials obtained from school records. Subjects worked under time conditions on puzzles selected from a series of twelve which were ranked and arranged in order of difficulty. They were allowed to choose the puzzle on which they worked. After the fifth task choice, the subjects were allowed to terminate the activity when they wished. Failure and success were insured by interrupting or allowing a subject to finish a puzzle; time pressure was applied at various points. The subjects were allowed to succeed on the first, second, and fifth tasks chosen and to fail on the third, fourth, sixth, seventh, and eighth tasks chosen. Success was allowed on all subsequent task choices. There were no significant differences between the well-adjusted and maladjusted groups when they were compared in terms of the following: frequency of raising or lowering goals after success and failure; average size of steps by which goals were raised or lowered after success and failure--on the total number of tasks and on each task; beginning level of aspiration; number of voluntary choices after the fifth task; sum of upward and downward shifts in level of aspiration; amount of time required to decide on puzzle choice; judged overt emotional response to failure and success; number of subjects recalling success and failure after the task sequence was finished; and number of subjects recalling the number of times they raised or lowered their goals after success and failure. On the other hand, a significantly larger number of well-adjusted subjects followed a previously planned sequence of puzzle choices. And, a significantly larger number of maladjusted subjects discontinued the task sequence after failure.

Summary of the Literature

The literature relevant to the topics with which this investigation is concerned includes studies of the relative performance on intellectual tasks of subjects who are similar in terms of mental age and dissimilar in terms of intelligence level, and studies of the effect of several conditions of reinforcement upon the responses of children. These have been reviewed in detail in the preceding sections; the evidence accrued is listed briefly below.

Relative Performance

Investigators of the relative intellectual performance of subjects who have similar mental age levels but different intelligence quotients primarily have directed their attention to three types of tasks, to wit: psychometric tests, academic achievement tests, and tasks involving more immediate learning.

Relative performance on psychometric tests.--In general, retarded subjects performed more adequately than did subjects who had higher intelligence upon psychometric subtests which involved motor manipulation and information and knowledge obtained over a long period of time.

On the other hand, the performance subjects who had higher intelligence exceeded the performance of retarded subjects upon psychometric subtests which involved immediate rote memory, comprehension, reasoning, and response to abstract concepts (8, 14, 21, 24, 25, 27, 33, 54, 64, 67, 68, 71, 95, 97, 105).

Relative performance on academic achievement tests.--Subjects who had higher intelligence performed more adequately upon reading and arithmetic tasks which involved reasoning and comprehension than did retarded subjects (19, 26, 54, 71).

Subjects who had higher intelligence and retarded subjects performed with equivalent adequacy upon reading and arithmetic tasks which involved mechanics and/or fundamentals (19, 26, 54, 71).

Subjects who had higher intelligence performed more adequately or with equivalent adequacy upon spelling tasks when compared with retarded subjects (26, 54, 71).

Subjects who had higher intelligence performed more adequately or less adequately than did retarded subjects when they were compared upon the basis of handwriting (54, 71).

Subjects who had higher intelligence showed larger increments in academic performance over a relatively long period of time than did retarded subjects (22, 74).

Relative performance on tasks involving immediate learning.--Retarded subjects performed more adequately or with similar adequacy upon direct sensorimotor learning tasks when compared with subjects who had higher intelligence (53, 107).

Retarded subjects performed less adequately (but no significance figures were presented) upon a discrimination learning task than subjects who had higher intelligence (91).

Retarded subjects performed more adequately, less adequately, or with equivalent adequacy upon direct rote learning tasks when compared with subjects who had higher intelligence (12, 53).

Retarded subjects and subjects who had higher intelligence performed with equivalent adequacy upon learning tasks involving reasoning or the discovery and application of an underlying relationship (53).

Retarded subjects and subjects who had higher intelligence were homogeneous in terms of within groups variability of performance upon tasks involving sensorimotor learning, rote learning, and reasoning (53, 108).

Retarded subjects and subjects who had higher intelligence showed equivalent increments or decrements in performance upon the same trials of tasks involving sensorimotor learning, rote learning, and reasoning (53).

Retarded subjects and subjects who had higher intelligence did not differ in terms of retention of serial rote learning as it was reflected in recognition, recall, and savings scores. On a paired associate rote learning task, subjects who had higher intelligence manifested retroactive inhibition; retarded subjects did not (53).

When compared with subjects who had higher intelligence, retarded subjects performed more adequately, less adequately, or with equivalent adequacy in situations involving the positive or negative transfer of sensorimotor learning (17, 107), rote learning, an underlying relationship or principle, and a general method (53).

Reinforcement Conditions

It is possible to identify two general topics which have been of concern to investigators of the effectiveness of material reward, praise and reproof, competition, success and failure, and of goal setting as incentive-reinforcement for children. That is to say, investigators in this area have attempted to assess the influence of the several conditions of reinforcement upon the responses of these subjects and to evaluate the role of certain variables as determinants of possible differential responses to these reinforcement conditions. The results of these studies would seem amenable to classification into the following categories: the effect of reinforcement administration on task performance (including the role of procedural and task variables); the effect of reinforcement administration upon the attractiveness of activities, resumption of interrupted tasks, persistence, and level of aspiration (including the role of procedural and task variables); and the influence of the age, sex, intelligence, academic achievement, and personality variables.

Effect of reinforcement administration upon task performance.--Subjects who received material reward performed more adequately than subjects who received verbal reward or no reward (1, 31, 99, 100).

Increased adequacy of performance was related to increased amounts of material reward administered during one session. This did not occur when different groups received different amounts or when the same subjects received increased amounts at different sessions (1, 99, 100).

Subjects who received material rewards during the latter half of trial sequences did not differ in total performance from subjects who received material reward throughout the trials; the groups differed during the initial half of the trials (1).

Actual and promised rewards were equally effective during the course of a single investigation; no attempt was made to determine whether this would have occurred if the same subjects had been employed in several investigations (31).

Subjects who received praise and reproof performed more adequately than control subjects (6, 32, 37, 43, 47, 48, 98). There were two exceptions in which these groups of subjects did not differ (9, 83).

During initial trials following reinforcement administration, praised and reproved subjects did not differ in performance (6, 37, 43, 47, 48, 98). There was one exception in which reproved subjects scored higher than praised subjects (32).

Ignored subjects, although they performed less adequately than praised and reproved subjects in the same room, scored higher than control subjects in another room (48).

When praise and reproof were administered in subsequent daily sessions, praised subjects showed continued increments in performance while reproved subjects showed decrements and the initial trial performance similarity between the subjects disappeared (48). This was not the case during subsequent administrations of incentive information during one experimental session (9, 32, 43, 83).

Different investigators using the same procedure did not obtain consistently different results when they administered praise and blame (83), or combined praise-reproof, success-failure, and reward-punishment (3, 5, 16).

Subjects responded in a similar manner to praise and reproof administered immediately and after one day (9).

Subjects competing with their own past scores (10, 56), subjects competing with other subjects (15, 13, 23, 61, 66, 77, 94, 102, 109), and subjects competing as group members against other groups (50) performed more adequately than control subjects who were not exposed to the several types of competition incentive.

Subjects performed more adequately when competing against other subjects than they did when competing as group members with other groups; they also performed more adequately than control subjects (65, 90). There was one exception in which no difference was found between the performance of subjects when they worked in the two competition situations (30).

Subjects who received success and failure information performed more adequately than control subjects (3, 5, 16).

The mean performance scores of subjects after they received interpolated success information were comparable to or lower than their mean performance scores on an initial task. After they received interpolated failure information, subjects' performance scores increased in variability, remained the same in mean size, or decreased in mean size (29, 35, 41, 51, 88, 93, 96).

Subjects who set levels of aspiration and received performance information initially performed more adequately than control subjects who did not set levels of aspiration or receive performance information. The former subjects showed increments in performance over a series of trials; the latter subjects showed decrements (4).

Effect of reinforcement administration on the attractiveness of activities and resumption of interrupted tasks.--Subjects designated as more attractive tasks on which they experienced success and less attractive tasks on which they experienced failure (28, 80, 81).

These relationships obtained whether the activity was described as easy or difficult or as dependent upon ability or chance factors (28).

Subjects who were successful in attaining goals set as levels of aspiration tended to resume an interrupted task more often than did subjects who were unsuccessful (103).

In situations designated as ego involving and as non-ego involving subjects did not differ in terms of tendency to resume interrupted tasks (103).

Effect of reinforcement administration on persistence.--Subjects who experienced intermittent failure followed by success were more persistent in responding to subsequent failure than subjects who had experienced only previous success. However, subjects who had experienced different amounts of initial intermittent failure did not differ in terms of persistence in responding to final failure (44).

Effect of reinforcement administration on level of aspiration.--Subjects who encountered success during a sequence of trials or tasks set increasingly higher levels of aspiration. Subjects who encountered failure responded in the opposite manner. These trends were accentuated in the cases of subjects who tended to respond with relatively greater intensity to success and failure (55, 86).

Subjects who were told that their performance levels exceeded that of the group set goals below their own performance levels but above that of the group. Subjects who were told that their performance level was below that of the group or within the intermediate ranges set their goals above their own performance levels and close to that of the group (44).

Subjects who succeeded on a task set their goals relatively high on a task judged to be similar while subjects who failed set their goals relatively low. This was not as apparent in the subjects' responses to a task judged to be dissimilar to the initial task (86).

The influence of the sex variable.--Boys and girls did not differ in response to praise and reproof or in level of aspiration behavior (47, 83, 106).

The influence of the age variable.--Subjects in different age groups did not differ in response to praise and reproof or in level of aspiration behavior (2, 47, 55, 83, 106).

Older subjects preferred to repeat tasks on which they had experienced failure; younger subjects, on which they had experienced success (80).

The influence of the intelligence variable.--Subjects in different intelligence groups responded in a similar manner to material rewards (1).

With practice effects removed, intellectually above average subjects performed more adequately after receiving praise and blame than did intellectually below average subjects; under control conditions, the former group performed less adequately than did the latter group (47).

Groups of subjects who had mean intelligence quotients of 100 and 70 did not differ in response to success information; in neither case, did their performance after success differ from that before success. On the other hand, a group of subjects who had a mean intelligence quotient of 79 required less trials to learn a task after interpolated success. After they received interpolated failure information, the groups did not differ; all performed less adequately (93).

Subjects who differed in terms of level of aspiration performance and tendency to resume an interrupted task did not differ in terms of mean intelligence (103).

The influence of personality variables.--Extroverts performed more adequately when reproved; introverts, when praised or reproved (32, 98).

Well-adjusted and maladjusted subjects did not differ in terms of response to praise and reproof (43).

Maladjusted subjects did not change their ratings of goal object attractiveness after success or failure; well-adjusted subjects rated tasks as more attractive after success and less attractive after failure (28).

Subjects who chose to repeat a task after failure, even though they had rated it as less attractive, were rated higher in terms of pride and desire to excell than were subjects who chose not to repeat the task after failure (80).

Subjects who differed in terms of readiness to resume interrupted tasks did not differ in terms of extroversion-introversion scores or adaptability ratings (103).

After failure, subjects characterized as submissive tended to perform less adequately than subjects characterized as ascendant (88, 96).

The mental ages of maladjusted subjects were higher when they were tested by an adapted method than by the standard method. There was no difference between the mental ages attained by well-adjusted subjects when the two types of administration were employed (51).

Subjects who differed in terms of assessments of personality or adjustment showed level of aspiration responses which were not significantly different (27, 36, 103) or which were significantly different (45, 63, 85).

The influence of the academic achievement variable.--With practice effects and the influence of initial ability removed, subjects rated by teachers as above average achievers performed more adequately after receiving praise and blame than did subjects rated as below average achievers. The latter subjects performed more adequately than the former subjects in a control situation (47).

Subjects who differed in terms of scores on academic achievement tests did not differ in terms of the size of their goal discrepancy scores (103, 106).

Subjects who had previous school histories of consistently good, medium, or poor achievement most often set goals in the high, medium, and low ranges respectively (55).

Subjects who had a past school experience of unsuccessful academic achievement had significantly higher goal discrepancy scores related to a reading task than did subjects who had a background of consistent academic success. These groups did not differ significantly in terms of goal discrepancy scores related to an arithmetic task. Nor did either group differ in these situations from a differential group whose past academic achievement was characterized by success in reading and failure in arithmetic. It was not demonstrated that the groups differed significantly in the reading and arithmetic situations in terms of variability of goal discrepancy scores, level of aspiration responses after success and failure, or secondary measures of level of aspiration designated as flexibility, responsiveness, or negative discrepancy. When these subjects were categorized in terms of reading task goal discrepancy scores--low positive, middle positive, high positive--, significantly more unsuccessful achievers were placed in the high positive category and significantly more successful and differential achievers were placed in middle positive categories; the latter two groups did not differ from each other in placement. No comparable significant differences between goal discrepancy scores related to an arithmetic task were noted (84).

Delimitation of the Problem

In the introductory section, questions were posed about two topics. The first topic pertained to the role of task variables in the relative intellectual performance of individuals who are similar in terms of mental age but different in terms of intelligence level and thus chronological age. The second topic pertained to the role of reinforcement conditions in the responses of these subjects. A large number of studies relevant to these two topics were reviewed and summarized. The present section includes the specific research questions developed on the basis of this background.

First, the results of the research on relative intellectual performance would seem to indicate that subjects who are similar in mental age and dissimilar in intelligence level show both similarities and differences in performance on various educational achievement and psychometric tests. The question whether these subjects would show comparable similarities and differences in performance on related tasks involving relatively immediate learning has been investigated also. It was expected that differences and similarities would occur and that these would be a function of the type of task and the aspect of performance being investigated. However, the results of these latter studies have not been unequivocal. Attempts were made to select tasks which reflected such functions as rote learning or sensorimotor learning, or functions which, at best, can be described behaviorally as "brightness" or "higher mental processes." However, these choices have not been concise and such variables as verbalization, motor manipulation, abstractness, etc., have not been controlled within any one investigation. It would seem that there is justification for an extension of this work. Therefore, one concern of the present study was the relative learning performance of three intelligence groups--intellectually retarded, normal, and superior subjects--who had similar mental ages as they responded to a series of verbal and non-verbal tasks; an attempt was made to vary these tasks along a dimension of complexity of the stimulus response variables involved.

The second topic of concern was reinforcement conditions. On the basis of the evidence obtained, it would seem justifiable to conclude that, in general, subjects to whom are administered an incentive-reinforcement--material reward, praise and reproof, competition set, or level of aspiration set--perform more adequately upon a variety of tasks than do control subjects. While the results relevant to the influence of success and failure information upon perceived attractiveness of activities and persistence are fairly consistent, the data pertaining to the effect of success and failure information upon task performance are not. Attempts to assess the role of subject and situational variables as determinants of response to reinforcement have yielded rather conclusive evidence that the influences of age, sex, and investigator differences are not significant within the populations studied. On the other hand, the effects of personality or adjustmental variables, intellectual variables, task variables, and experiential variables are uncertain. Only in relation to material reward have attempts been made to assess the consequences of varying the amount of the reinforcement or of the time in the performance sequence at which the reinforcement is introduced; nevertheless, discrepancies in the results were noted and more evidence would seem to be necessary before generalizations can be made.

These studies have contributed much to a body of knowledge about the use of reinforcement. Yet, many questions remain about the data cited above and about implications of these data. Some of these questions are related to the following issues: the effect of varying systematically the conditions of the reinforcement; the possible interaction of several reinforcement conditions; the relative effectiveness of reinforcement conditions when control subjects are given knowledge of results and when the reinforcement is administered to subjects individually rather than within a group; the relative effect of reinforcement variations on the responses of subjects who have similar mental ages and yet who differ in terms of intelligence level and experiential background; the influence of presenting the reinforcement information within the framework of different social orientations; and the relative influence of reinforcement conditions when task characteristics are varied. The studies located in the extensive search through the literature either did not pertain to or did not contain conclusive evidence relevant to these topics. They represent a concern of the present study.

Material rewards, praise and reproof, and competition probably all have value as educational incentives. In specific situations, they are considered to be the implicit goals of the subjects involved. However, in the final analysis, if the individual is to become effectively self-directed, then it is important that he learn to set his own explicit goals relevant to his performance and on the basis of his observed performance adequacy, and that he learn to perform within the context of the consequent success and failure. Thus, in an attempt to evaluate conditions conducive to this process, the level of aspiration framework was utilized and success or failure in reaching the set goals was employed as reinforcement.

In conclusion, the problems for investigation defined on the basis of many of the considerations discussed are implicit in these three topics: the effects of selected conditions of reinforcement on learning performance and level of aspiration behavior; goal setting behavior when conditions of reinforcement are held constant; and response to selected intellectual tasks when conditions of reinforcement are held constant. Evaluated in relation to each of these topics will be the role of variations in subject characteristics and of variations in task characteristics.

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CHAPTER II

PROCEDURE

Experimental Design

The intent of this investigation was to evaluate the responses of intellectually retarded, intellectually normal, and intellectually superior subjects as they performed six tasks each under three overlapping conditions of reinforcement. The conditions of reinforcement were designated type, frequency, and orientation and were administered within the framework of the level of aspiration technique. The experimental design considered appropriate is illustrated in Figure 1. Contained in the immediately succeeding sections are the definitions of the terms employed in reference to this experimental design and the descriptions of procedures utilized in effecting this plan for the investigation.

Subjects

Thirty-six subgroups of subjects--12 mentally retarded, 12 intellectually normal, and 12 intellectually superior--were required by the experimental design. The following discussion of the subjects will include the definitions of terms employed, the criteria and procedure utilized for selection of the subjects, and a description and comparison of the groups in terms of the subject variables: mental age, chronological age, and intelligence quotient.

Definition of Terms

For the purposes of this investigation, the following definitions of terms were employed in reference to the subjects.[1]

1. Intellectually superior subjects: Subjects whose intelligence quotients, as assessed by the Form L of the Stanford-Binet Test of Intelligence, 1937 Revision, are 120 or higher.

2. Intellectually normal subjects. Subjects whose intelligence quotients, as assessed by the Form L of the Stanford-Binet Test of Intelligence, 1937 Revision, are within the limits of 90 to 110.

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[1] Subsequently, the subjects will be referred to as superior, normal, and retarded, respectively.

Levels - Conditions[a]		(C) Type - Frequency					
(B) Intelligence	(D) Orientation	C1 100 Percent Success	C2 66 Percent Success- 33 Percent Failure	C3 33 Percent Success- 66 Percent Failure	C4 100 Percent Failure	C5 Level of Aspiration Control	C6 Speed and Accuracy Control
B1 Retarded Group	D1 Individual	1[b]	2	3	4	5	6
	D2 Group	7	8	9	10	11	12
B2 Normal Group	D1 Individual	1	2	3	4	5	6
	D2 Group	7	8	9	10	11	12
B3 Superior Group	D1 Individual	1	2	3	4	5	6
	D2 Group	7	8	9	10	11	12

Fig. 1.—Schematic Illustration of the Experimental Design.

[a] Throughout the study, the alphanumeric combinations cited within the figure are utilized in referring to the several combinations of intelligence levels and reinforcement conditions or treatments.

[b] The numbers which appear within the cells were designated as the base cell numbers. The groups of subjects originally assigned randomly to these cells were termed the base cell groups. For the several tasks, these base cell groups were assigned to different combinations of reinforcement conditions or treatments.

3. Mentally handicapped subjects. Subjects whose intelligence quotients, as assessed by the Form L of the Stanford-Binet Test of Intelligence, 1937 Revision, are within the limits of 55 to 75.

4. Mental age. A quantitative index reflecting the total number of items successfully completed by the subject on the Form L of the Stanford-Binet Test of Intelligence, 1937 Revision.

Criteria for Selection of the Subjects

White retarded, normal, and superior subjects who satisfied the following requirements were selected for possible inclusion in the study.

1. Mental ages within the limits of 8 years, 0 months and 11 years, 6 months.
2. Enrollment in public school regular classes (normal and superior subjects) or special classes (retarded subjects).
3. Absence--as judged by the classroom teacher, the principal, the visiting teacher, the school psychologists, or the investigators--of any major emotional disturbance which might be detrimental to performance on the tasks.
4. Absence of gross, physical, sensory or speech impairments or minor uncorrected impairments.

Procedure for Selection of the Subjects

School records, including the results of previous psychometric and academic achievement tests, were scrutinized and conferences were held with classroom teachers, visiting teachers, school psychologists, and/or principals. On the basis of information thus obtained, prospective lists of subjects were prepared. Over a 3-month period, the investigators administered the Form L of the Stanford-Binet Test of Intelligence, 1937 Revision to 539 subjects enrolled in 23 schools. The subjects' chronological ages and mental ages were re-calculated in terms of the date, December 31, 1958. Of this total group, 154 retarded subjects, 111 normal subjects, and 104 superior subjects satisfied the selection criteria. At this stage, the primary reason for rejection of subjects was their attainment of mental ages and/or intelligence quotients above or below the limits established for the study. In order to prevent the sequential arrangement of subjects by schools, within each intelligence group the subjects from the several schools were pooled and listed in irregular order. The subjects in the resulting lists were assigned numbers from 1 to the total number in the group. A table of random numbers was utilized in assigning subjects in each intelligence group to the 12 subgroups. Eight subjects were assigned to each subgroup corresponding to the several cells of the experimental design. The lists of subjects in each of these base cell groups are contained in Appendix B. These lists include each subject's code number, school code number, mental age, chronological age, intelligence quotient.[1]

Description and Comparison of the Groups in Terms of the Subject Variable

Listed in Tables 1, 2, and 3 are the descriptive statistics pertinent to the status of the groups in terms of the subject variables: MA, CA, and IQ. Table 1 is composed of the mean (rounded)MA's, CA's, and IQ's of the subjects in each of the base cell groups. The corresponding variances (rounded) appear in Table 2. Table 3 consists of the means and variances (rounded) of the subjects' MA's, CA's, and IQ's when the groups are combined according to the several treatments or levels classifications.[2]

The purpose of this investigation was to obtain data pertinent to a series of research questions. In view of the nature of these questions, it was desirable that certain conditions related to the subject variables exist as nearly as possible. These conditions were the following:

1. the within group variances in all comparisons are homogenous;
2. the subjects in the retarded subgroups do not differ significantly in terms of MA and IQ (and CA);
3. the subjects in the normal subgroups do not differ significantly in terms of mean MA and IQ (and CA);
4. the subjects in the superior subgroups do not differ significantly in terms of mean MA and IQ (and CA);

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[1] Subsequently, these three subject variables will be referred to as MA, CA, and IQ, respectively.

[2] For convenience and clarity, during the ensuing discussion of statistical data, the intelligence groups (B) will be referred to as groups or levels; the subgroups of subjects receiving the several type-frequency (C) and orientation (D) reinforcement conditions will be alluded to as treatment groups or subgroups, and the subgroups of subjects defined when the several treatments or treatments and levels overlap will be designated as treatments and/or treatments by levels combinations.

TABLE 1

DESCRIPTION OF THE RETARDED (B1), NORMAL (B2), AND SUPERIOR (B3) BASE CELL GROUPS IN TERMS OF THE SUBJECT VARIABLES: MENTAL AGE, CHRONOLOGICAL AGE, AND INTELLIGENCE QUOTIENT (MEANS)

Variable	Level	Condition	Base Cell Group											
			C1		C2		C3		C4		C5		C6	
			Cell	$\bar{X}$	Cell	$\bar{X}$	Cell	$\bar{X}$	Cell	$\bar{X}$	Cell	$\bar{X}$	Cell	$\bar{X}$
Mental Age	B1	D1	1	120	2	117	3	116	4	116	5	117	6	116
		D2	7	117	8	116	9	114	10	116	11	117	12	116
	B2	D1	1	117	2	117	3	117	4	117	5	117	6	117
		D2	7	119	8	117	9	117	10	115	11	117	12	117
	B3	D1	1	126	2	126	3	128	4	127	5	127	6	126
		D2	7	127	8	126	9	126	10	128	11	125	12	127
Chronological Age	B1	D1	1	177	2	177	3	176	4	183	5	173	6	176
		D2	7	177	8	171	9	167	10	171	11	174	12	172
	B2	D1	1	113	2	117	3	112	4	120	5	117	6	118
		D2	7	112	8	109	9	111	10	115	11	114	12	115
	B3	D1	1	100	2	100	3	100	4	100	5	95	6	95
		D2	7	100	8	96	9	99	10	102	11	99	12	99
Intelligence Quotient	B1	D1	1	70	2	69	3	69	4	68	5	71	6	69
		D2	7	70	8	71	9	70	10	70	11	70	12	70
	B2	D1	1	103	2	100	3	104	4	98	5	99	6	99
		D2	7	106	8	107	9	105	10	101	11	103	12	101
	B3	D1	1	127	2	126	3	127	4	128	5	134	6	133
		D2	7	128	8	133	9	130	10	127	11	126	12	129

TABLE 2

DESCRIPTION OF THE RETARDED (B1), NORMAL (B2), AND SUPERIOR (B3) BASE CELL GROUPS IN TERMS OF THE SUBJECT VARIABLES: MENTAL AGE, CHRONOLOGICAL AGE, AND INTELLIGENCE QUOTIENT (VARIANCES)

Variable	Level	Condition	Base Cell Group											
			C1		C2		C3		C4		C5		C6	
			Cell	S²	Cell	S²	Cell	S²	Cell	S²	Cell	S²	Cell	S²
Mental Age	B1	D1	1	125	2	123	3	176	4	39	5	106	6	124
		D2	7	50	8	100	9	80	10	74	11	94	12	90
	B2	D1	1	135	2	130	3	104	4	100	5	213	6	39
		D2	7	172	8	110	9	136	10	73	11	233	12	170
	B3	D1	1	96	2	69	3	113	4	106	5	73	6	115
		D2	7	110	8	62	9	108	10	71	11	232	12	38
Chronological Age	B1	D1	1	155	2	179	3	151	4	442	5	276	6	125
		D2	7	288	8	277	9	208	10	155	11	287	12	165
	B2	D1	1	26	2	94	3	114	4	90	5	112	6	64
		D2	7	85	8	96	9	85	10	121	11	127	12	87
	B3	D1	1	44	2	81	3	110	4	75	5	29	6	69
		D2	7	54	8	102	9	112	10	101	11	153	12	42
Intelligence Quotient	B1	D1	1	22	2	41	3	32	4	23	5	15	6	38
		D2	7	3	8	35	9	10	10	13	11	13	12	26
	B2	D1	1	68	2	62	3	22	4	62	5	37	6	38
		D2	7	27	8	34	9	58	10	43	11	77	12	70
	B3	D1	1	28	2	20	3	45	4	33	5	130	6	145
		D2	7	22	8	108	9	112	10	105	11	62	12	47

TABLE 3

DESCRIPTION IN TERMS OF THE SUBJECT VARIABLES OF GROUPS CLASSIFIED ACCORDING TO LEVELS AND TREATMENTS (MEANS AND VARIANCES)

			N	Mental Age		Chronological Age		Intelligence Quotient	
				$\overline{X}$	S^2	$\overline{X}$	S^2	$\overline{X}$	S^2
Within Intelligence Groups	Retarded Group (B1)	Orientation groups (D)--C Category ignored							
		D1	48	117	100	177	204	69	22
		D2	48	116	79	172	231	70	20
		Type-frequency groups (C)--D Category ignored							
		C1	16	118	80	177	288	70	22
		C2	16	116	58	174	214	70	8
		C3	16	115	107	172	217	70	27
		C4	16	116	91	177	267	69	22
		C5	16	117	140	174	129	70	33
		C6	16	116	80	174	182	70	17
	Normal Group (B2)	Orientation groups (D)--C Category ignored							
		D1	48	117	118	116	80	100	44
		D2	48	117	124	113	94	104	51
		Type-frequency groups (C)--D Category ignored							
		C1	16	118	110	112	68	104	69
		C2	16	117	118	113	97	104	38
		C3	16	117	160	112	96	104	46
		C4	16	116	160	118	110	100	57
		C5	16	117	67	116	93	101	35
		C6	16	117	143	116	83	101	64

TABLE 3--Continued

			N	Mental Age		Chronological Age		Intelligence Quotient	
				$\overline{X}$	S^2	$\overline{X}$	S^2	$\overline{X}$	S^2
Within Intelligence Groups	Superior Group (B3)	Orientation groups (D)--C Category ignored							
		D1	48	127	83	98	77	129	55
		D2	48	126	87	99	65	129	87
		Type-frequency groups (C)--D Category ignored							
		C1	16	126	94	100	56	128	29
		C2	16	126	85	98	73	130	60
		C3	16	127	67	100	59	128	88
		C4	16	128	112	101	88	128	87
		C5	16	126	107	97	92	130	100
		C6	16	126	68	97	72	131	75
Between Intelligence Groups		Intelligence groups (B)--D and C Categories ignored							
		B1	96	117	89	175	215	70	21
		B2	96	117	120	115	90	102	51
		B3	96	127	89	99	76	129	70
		Orientation groups (D)--B and C Categories ignored							
		D1	144	120	119	131	1,257	99	649
		D2	144	120	121	128	1,137	101	628
		Type-frequency groups (C)--B and D Categories ignored							
		C1	48	121	119	130	1,264	101	598
		C2	48	120	109	129	1,226	101	659
		C3	48	120	135	128	1,114	101	635
		C4	48	120	99	132	1,263	99	625
		C5	48	120	159	129	1,239	101	667
		C6	48	120	108	129	1,179	100	703

5. the subjects in the retarded, normal, and superior subgroups do not differ significantly in terms of mean MA but do differ in terms of mean IQ (and CA).

The statistical techniques (2, 10) utilized to evaluate the comparative subject data pertinent to these conditions were the Bartlett test of homogeneity of variance, two factor analyses of variance within each intelligence group (treatments x treatments--B : D x C) and two factor analyses of variance across the three intelligence groups (levels x treatments x treatments--B x D x C). The criterion for rejection of the null hypotheses was the .01 level of probability.[1]

In cases in which the chi square obtained by means of the Bartlett test was associated with a probability of .01 or less, the null hypothesis was rejected and it was inferred that marked heterogeneity existed among the within-group variances of the groups compared. In such cases, when the groups of subjects involved were compared in terms of the relationship of their means, the criterion for the rejection of the null hypotheses was changed to the .001 level of probability.

When, in the analyses of the variance of the means, the F ratios associated with the levels, the treatments, or the several combinations were significant, the means of the subjects in the classifications involved were scrutinized more closely. These more discrete analyses were made by employing an over-all critical difference technique when the evidence indicated that the relevant error variances were homogenous. When such homogeneity of variance was not indicated, independent t tests and the Cochran-Cox (1) adjustment were utilized.

Presented in Tables 4 through 9 are statistical data pertinent to the comparisons of the groups in terms of the subject variables: MA, CA, and IQ. These data will be discussed within the framework of each of the conditions listed above as desirable.

Condition 1: The within-group variances in all comparisons are homogenous

Reference to Table 4 reveals that this condition was fulfilled insofar as the MA variable was concerned; i.e., the several chi squares were not significant. This was not the case when similar comparisons were made of the subjects' CA's and IQ's. A significant chi square resulted from the analysis of the CA variance of the subjects in the total retarded, normal, and superior groups. However, the remaining chi squares associated with the CA variances were not significant; accordingly, it would seem justifiable to believe that the heterogeneity of variance did not occur differentially. There was also a significant chi square associated with the comparison of the IQ variances of the total groups of subjects. The significant chi square yielded by the B x D x C comparison indicated that the heterogeneity of variance was manifested when the 36 base cells, or, treatments by treatments by levels combinations, were considered separately. Otherwise, in the remainder of the comparisons the chi squares were not significant and it would seem possible to suppose that the heterogeneity of IQ variance did not occur differentially in the classifications of subjects involved. Thus, the condition was fulfilled in terms of MA and partially fulfilled in terms of CA and IQ.

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[1] See section entitled Plan for the Analyses of the Results for a discussion of the issues involved in this decision.

Condition 2: The subjects in the retarded subgroups do not differ significantly in terms of mean MA, IQ (and CA)

The data relevant to this condition are contained in Table 5. Inspection of these data reveal that in no case are the several F ratios significant. Therefore, the condition was fulfilled.

Condition 3: The subjects in the normal subgroups do not differ significantly in terms of mean MA, IQ (and CA)

Table 6 consists of the appropriate statistical data. Examination of the table reveals that none of the F ratios are significant. Hence, the condition can be regarded as fulfilled.

Condition 4: The subjects in the superior subgroups do not differ significantly in terms of mean MA, IQ (and CA)

The pertinent statistical data are listed in Table 7. Scrutiny of the table reveals that the condition was met. None of the F ratios are significant.

Condition 5: The subjects in the retarded, normal and superior subgroups do not differ significantly in terms of mean MA but do differ in terms of mean IQ (and CA)

Table 8 includes the statistical data relevant to this condition. Reference to the data included in this table indicates that the following relationships obtained. When the mental age differences among the total groups of subjects were analyzed, a significant F ratio resulted. However, the F ratios associated with differences among treatment groups and the several treatments, and treatments by levels combinations were not significant. Thus, even though the evidence indicates that the total groups differed significantly in terms of MA, it is possible to believe that these differences are distributed evenly among the several treatments and combinations. The evidence related to the comparisons of the subjects in terms of CA and IQ suggests that similar relationships occur in these cases. That is, the F ratios associated with the variances of the means of the total groups are significant and those associated with the variance of the means of the several treatments and combinations are not.

The next step is to localize the differences which do exist. It will be remembered that the within groups MA variances of the total retarded, normal, and superior groups of subjects

TABLE 4

COMPARISON OF THE GROUPS IN TERMS OF THE SUBJECT VARIABLES: MENTAL AGE, CHRONOLOGICAL AGE, AND INTELLIGENCE QUOTIENT (VARIANCES)

			Number Subjects Each Group	Number Groups	df Groups-1	χ^2		
						MA	CA	IQ
Within Intelligence Groups	Retarded	D	48	2	1	0.67	0.18	0.09
		C	16	6	5	3.26	2.88	8.13
		DC	8	12	11	5.79	5.36	15.09
	Normal	D	48	2	1	0.02	0.31	0.24
		C	16	6	5	3.59	0.95	2.87
		DC	8	12	11	7.57	4.97	5.76
	Superior	D	48	2	1	0.02	0.36	2.30
		C	16	6	5	1.76	1.49	6.27
		DC	8	12	11	7.36	8.17	17.26
Between Intelligence Groups		B	96	3	2	2.95	31.59*	31.51*
		D	144	2	5	3.66	0.27	0.37
		C	48	6	1	0.004	0.35	0.04
		BDC	8	36	35	23.40	42.26	63.41*

** $P < .01$

TABLE 5

COMPARISON OF THE RETARDED (B1) SUBGROUPS IN TERMS OF THE SUBJECT VARIABLES: MENTAL AGE, CHRONOLOGICAL AGE, AND INTELLIGENCE QUOTIENT (MEANS)

Variable	Source	df	SS	MS	F
Mental Age	D	1	3.01	3.01	.24
	C	5	13.26	2.65	.22
	DC	5	2.68	.54	.04
	Within cells	84	1,032.00	12.92	
	Total	95	8,314.88		
Chronological Age	D	1	78.85	78.85	2.79
	C	5	50.60	10.12	.36
	DC	5	61.76	12.35	.44
	Within cells	84	2,370.37	28.22	
	Total	95	20,492.00		
Intelligence Quotient	D	1	1.88	1.88	.66
	C	5	2.51	.50	.18
	DC	5	2.27	.45	.16
	Within cells	84	237.81	2.83	
	Total	95	1,900.48		

TABLE 6

COMPARISON OF THE NORMAL (B2) SUBGROUPS IN TERMS OF THE SUBJECT VARIABLES: MENTAL AGE, CHRONOLOGICAL AGE, AND INTELLIGENCE QUOTIENT (MEANS)

Variable	Source	df	SS	MS	F
Mental Age	D	1	.07	.07	.00
	C	5	2.54	.51	.03
	DC	5	4.46	.89	.05
	Within cells	84	1,413.67	16.83	
	Total	95	11,281.80		
Chronological Age	D	1	36.75	36.75	3.20
	C	5	48.78	9.76	.85
	DC	5	18.94	3.79	.33
	Within cells	84	965.28	11.49	
	Total	95	8,576.32		
Intelligence Quotient	D	1	26.23	26.23	4.22
	C	5	51.75	10.35	1.66
	DC	5	9.03	1.81	.29
	Within cells	84	522.53	6.22	
	Total	95	4,827.20		

TABLE 7

COMPARISON OF THE SUPERIOR (B3) SUBGROUPS IN TERMS OF THE SUBJECT VARIABLES: MENTAL AGE, CHRONOLOGICAL AGE, AND INTELLIGENCE QUOTIENT (MEANS)

Variable	Source	df	SS	MS	F
Mental Age	D	1	.34	.34	.03
	C	5	3.53	.71	.06
	DC	5	5.01	1.00	.08
	Within cells	84	1,042.75	12.41	
	Total	95	8,514.24		
Chronological Age	D	1	.94	.94	.09
	C	5	25.60	5.12	.51
	DC	5	23.10	4.62	.46
	Within cells	84	851.04	10.13	
	Total	95	7,213.16		
Intelligence Quotient	D	1	.33	.33	.04
	C	5	22.03	4.41	.49
	DC	5	69.66	13.93	1.56
	Within cells	84	750.71	8.94	
	Total	95	6,680.08		

TABLE 8

COMPARISON OF THE RETARDED (B1), NORMAL (B2), AND SUPERIOR (B3) GROUPS IN TERMS OF THE SUBJECT VARIABLES: MENTAL AGE, CHRONOLOGICAL AGE, AND INTELLIGENCE QUOTIENT (MEANS)

Variable	Source	df	SS	MS	F
Mental Age	B	2	772.97	386.49	27.93**
	D	1	1.41	1.41	.10
	C	5	6.17	1.23	.09
	BD	2	2.00	1.00	.07
	BC	10	13.15	1.32	.10
	DC	5	2.08	.42	.03
	BDC	10	10.09	1.01	.07
	Within cells	252	3,488.41	13.84	
	Total	287	34,517.00		
Chronological Age	B	2	38,327.68	19,163.84	551.71^{***a}
	D	1	65.05	65.05	3.92
	C	5	56.70	11.34	.68
	BD	2	51.50	25.75	1.55
	BC	10	68.28	6.83	.41
	DC	5	53.87	10.77	.65
	BDC	10	49.93	4.99	.30
	Within cells	252	4,186.69	16.61	
	Total	287	342,921.80		
Intelligence Quotient	B	2	21,161.86	10,580.93	96.82^{***a}
	D	1	11.66	11.66	1.94
	C	5	22.65	4.53	.76
	BD	2	16.77	8.39	1.40
	BC	10	53.61	5.36	.89
	DC	5	37.88	7.58	1.26
	BDC	10	43.11	4.31	.72
	Within cells	252	1,511.05	6.00	
	Total	287	182,677.84		

$^{**}p < .01$

$^{***}p < .001$

^{a}(Significant chi squares were yielded by the analyses of the corresponding within groups variances.)

were homogenous and that the CA and IQ variances were not. Consequently, the critical difference technique was utilized to compare the mean MA's; and independent t tests were employed to evaluate the differences among the mean CA's and the mean IQ's. The results of these analyses are summarized in Table 9. These results suggest the following relationships. The mean MA's of the retarded and normal groups were equivalent. The mean MA of the superior group was significantly larger than that of the normal group and that of the retarded group. As expected, the mean CA of the retarded group was significantly larger than those of the normal and superior groups; in turn, the mean CA of the normal group was significantly larger than that of the superior group. Also, as expected, the reverse occurred when the groups were compared in terms of mean IQ. The mean IQ of the superior group exceeded those of the normal and retarded groups, and the mean IQ of the normal group was greater than that of the retarded group. All of these data indicate that the desired condition was fulfilled insofar as CA and IQ were concerned and only partially fulfilled insofar as MA was concerned.

In summary, it was desirable that there exist 5 conditions pertinent to the relationships among the groups of subjects in terms of MA, CA, and IQ. Statistical evidence relevant to these conditions was presented. This evidence indicated that the conditions were fulfilled in most cases. The inferences that these data would seem to justify may be listed as follows.

1. The populations of subjects sampled are homogenous in terms of MA variance. They are heterogeneous in terms of CA variance and IQ variance; however, the heterogeneity of CA variance is not evident when the subjects are categorized according to treatments classifications or the several combinations. The heterogeneity of IQ variance is not manifested when the subjects are categorized according to treatments classifications but is evident when they are categorized according to the treatment x treatment x levels combinations.

2. The retarded population or populations of subjects sampled are homogenous in terms of mean MA and IQ (and CA).

3. The normal population or populations of subjects sampled are homogenous in terms of mean MA and IQ (and CA).

4. The superior population or populations of subjects sampled are homogenous in terms of mean MA and IQ (and CA).

5. The retarded and normal populations sampled are similar in terms of mean MA and different in terms of mean IQ (and CA). The populations represented by these two and the superior population or populations of subjects sampled are different in terms of mean MA, CA, and IQ. The differences cited are distributed in a similar manner when the subjects are categorized in terms of treatment classifications and the several treatments and treatments by levels combinations.

TABLE 9

INDIVIDUAL COMPARISONS OF THE RETARDED (B1), NORMAL (B2), AND SUPERIOR (B3) GROUPS IN TERMS OF THE SELECTION VARIABLES: MENTAL AGE, CHRONOLOGICAL AGE, AND INTELLIGENCE QUOTIENT (MEANS)

Mental Age

$\bar{X}$		117	117	127
	Group	B1	B2	B3
117	B1	-	0	10^{**}
117	B2		-	10^{**}
127	B3			-

Critical difference (d) = 1.37

$^{**}p < .01$

Chronological Age[a]

$\bar{X}$			175	115	99
	Group		B1	B2	B3
175	B1	Diff *t*	- -	-60 33.71	-76 42.13
115	B2	Diff *t*		- -	16 12.21
99	B3	Diff *t*			- -

Intelligence Quotient[a]

$\bar{X}$			70	102	129
	Group		B1	B2	B3
70	B1	Diff *t*	- -	32 37.21	59 60.83
102	B2	Diff *t*		- -	27 23.21
129	B3	Diff *t*			- -

[a] **All *t*-ratios significant at less than the .001 level**

Tasks

Six tasks were administered individually to the subjects. These included a verbal and a non-verbal form of tasks designed to involve discrimination learning, rote learning, and concept formation. The subsequent discussion will consist of the definitions of terms employed in reference to the tasks, the criteria utilized for the selection of the tasks, and a description of each task in terms of its purpose, characteristics, materials, procedures, and directions.

Definition of Terms

For the purposes of this investigation, the terms employed in reference to the tasks were defined as follows.

1. Learning performance. Increments or decrements in the response measures under the conditions of practice (13).

2. Discrimination learning. Association of a single response with a single stimulus--emphasis upon the selection of, and the subsequent response to, the correct or positive stimulus from among several stimuli (19).

3. Rote learning. Association (arbitrary) and integration of a series of discrete responses with a series of discrete stimuli (18).

4. Concept formation. Association of a single response with a series of different stimuli which may be categorized on the basis of a common underlying relationship (18).

5. Verbal task. Task on which overt response requires oral manipulation of verbal symbols with the face-to-face researcher-subject situation at a maximum (13).

6. Non-verbal task. Task on which overt response requires manipulation of task materials with the face-to-face researcher-subject situation at a minimum (13).

Criteria for Selection of the Tasks

The characteristics of the tasks utilized were determined primarily by the aspects of learning being evaluated. In addition, the requirements of evaluating relative effects of different conditions of reinforcement, the characteristics of the subjects, and the exigencies of research arrangements within the school situation dictated the following practical criteria.

1. Interesting. The activity had to be one in which the subject would not dislike participating.

2. Novel. The task (i.e., the materials and/or the manner in which they were manipulated) had to be one with which it was believed that the subject had not had specific prior experience. However, the task could not be so removed from the subject's realm of experience that its strangeness would create a disturbing factor.

3. Appropriate Time Length. Performance on the tasks could not be so time consuming that participation in the investigation would make unreasonable demands upon the time of the subject who was concurrently engaged in academic work.

4. Moveable Equipment. The equipment and/or test materials had to be such that they could be moved from location to location and used in rooms in which there were no special facilities.

5. Non-fatiguing. The activity had to be such that an adequate sample of the subject's performance could be obtained before fatigue occurred.

6. Wide Range of Possible Scores. The activity had to be such that subjects widely varying in CA and IQ all could respond with some improvement of performance; i.e., it had to be neither too hard nor too easy and have a scoring continuum over a relatively large number of trials.

7. Control of Information. The activity had to be such that the investigator could control the signalling of the response measures; i.e., the subject could obtain no independent knowledge of the adequacy of his responses.

8. Similarity. While the tasks had to reflect several aspects of learning, consistency in general form and procedure was desirable in order to facilitate comparisons of responses from task to task.

9. Ego-involving. The task (i.e., the materials and the manner in which they were manipulated) had to be similar enough to school activities and to be presented in such a manner that the subjects would accept the situation as a bona fide one and consider it highly important to respond as adequately as possible.

Description of the Tasks

A large number of learning studies were examined. Tentatively appropriate tasks were selected and adapted. These tasks were pilot tested extensively with approximately second to fifth grade intellectually normal children employed as subjects. Modifications were made until the above listed requirements appeared to be satisfied. The tasks thus developed were designed as the discrimination learning verbal task (DLV), the discrimination learning non-verbal task (DLN), the rote learning verbal task (RLV), the rote learning non-verbal task (RLN), the concept formation verbal task (CFV), and the concept formation non-verbal task (CFN).[1]

All of the tasks involved multiple items. To the subjects, all were designated as tests. Before each task was initiated, the investigator worked through an example with the subject; every effort was made at this time and during the task administration to insure that the subject understood how to perform the task. In the verbal tasks, the investigators employed a simultaneous oral and visual presentation of the task materials, the subject responded orally, and the investigator orally designated his responses as correct or incorrect. The subject had to discover the correct responses and he began by guessing. In the non-verbal situations, the investigator presented the materials visually in the form of a pencil and paper task. The subject made a written response. A demonstration containing the correct responses was supplied and the subject was required to refer to it whenever necessary. If errors occurred, these were cited after the trial was completed.

The Discrimination Learning Verbal Task

The McClelland (12) technique for studying serial verbal discrimination learning was modified in terms of the requirements of the present investigation. The contrast method of discrimination learning was employed; e.g., the subject was required to respond to the selected stimulus and to not respond to similar simultaneously presented stimuli. The first trial is cited for illustration and the correct responses are designated.

Trial 1	Cue Word	Response Alternates			
a	brafen	bwadex	bargnf	jaxemb	wahenj
b	gitsum	bivart	kygmrs	wospum	gmidav
c	kovjel	nakjoq	wekajy	vaxkeh	brokyl

The positive stimuli were the f, t, and l sounds. Respectively, these were imbedded in the cue words--brafen, gitsum, and kovjel--and in one of the four alternates in each item. The subject's task was to discover the positive stimuli and to demonstrate this discovery by choosing the correct alternatives.

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[1] Subsequently, the tasks will be referred to by the letter abbreviations included in the parentheses.

The investigator showed the subject a card containing each item and read to him the cue word and the four alternates. The subject began by guessing the correct alternate. The investigator verbally designated each guess as correct or incorrect. After the subject made a correct guess, the next item was initiated.

The task consisted of an example and 24 trials. The cue words remained the same throughout the trials. The alternates were changed each trial. In addition, the vertical position of the cue words and the horizontal position of the correct alternates were varied according to an irregular order from trial to trial.

The performance measures were the number of responses required each trial to select the correct alternates and the time required to complete the trial.

Included in Appendix C are detailed descriptions of the example and the complete task, the methods employed in constructing the task, and the procedures and directions employed in administering the task to the subject.

The Discrimination Learning Non-Verbal Task

The Woodworth-Wells cancellation test (20) was adapted to conform to the requirements of the present investigation. As in the DLV, the contrast method was used. The initial trial is presented for illustration.

Trial 1

Key--Positive Stimuli		2		9		6	
Response Alternates	503	155	684	433	490	302	357
	718	307	170	210	747	500	110
	435	838	568	109	331	431	117
	841	953	340	328	585	516	388
	747	114	705	514	604	740	801
	597	782	184	385	708	834	860
	779	580	442	334	175	235	505
	136	723	771	953	553	709	350
	443	885	717	507	482	394	380
	140	317	632	718	457	815	884

The positive stimuli are the digits 2, 9, and 6. These are presented in the key and in 21 of the 70 three-digit alternates. For each positive stimulus, there are 7 correct alternates; i.e., three-digit number series containing the positive stimulus.

The subject's task was to refer to the key to determine the positive stimuli and then to locate the correct alternates: those containing the positive stimuli.

A separate page containing each entire trial was presented to the subject. Referring to the key as often as necessary, he underlined with a pencil all of the correct alternates on the page. During the trial, the investigator noted the subject's inaccuracies and omissions and after the trial was completed, called them to his attention. (In general, errors were at a minimum.)

The task consisted of 18 trials. The demonstration key containing the positive stimuli remained the same for all trials. Changed from trial to trial were the combinations of numbers composing the alternates and the position of the correct alternates within the context of the 70 three-digit number series.

The performance measure was time required to complete each trial.

Included in Appendix D is a presentation of the example and the complete task, a detailed description of the method by which the task was constructed, and the procedure and directions utilized in administering the task to the subject.

The Rote Learning Verbal Task

The RLV consisted of a variation of the conventional paired associates technique (18). The anticipation method was employed. The materials used in initiating the task proper are the following.

Demonstration	Stimuli	Responses
a	maz	wib
b	zic	kuh
c	bef	yot
d	doj	paf
e	giq	jeh
Trial 1		
a	maz	
b	zic	
c	bef	
d	coj	
e	giq	

The subject's task was to learn the stimulus-response pairs and to demonstrate this knowledge by supplying orally the response member when the investigator said the stimulus member.

To initiate the task proper, the investigator showed the subject a card containing the 5 paired associates, and read them aloud to him at the rate of about 2 seconds per pair. In Trial 1, the investigator exposed a card containing only the stimulus syllables. After the investigator read each stimulus syllable, the subject was required to say the response syllable. Wrong responses were so designated. When the correct response syllable was cited, it was labeled right and the next item was considered. If the subject could supply no response syllables or if he did not supply the correct response syllable within 10 seconds, the examiner named it and the next item was initiated.

There were 24 trials in the task. The stimulus-response pairs of syllables remained the same but their vertical placement in the list was determined according to an irregular order.

The performance measures were the number of responses supplied per trial[1] and the time required to complete the trial (50 seconds being the maximum amount of time possible).

In Appendix E are contained a presentation of the example and the 24 trials of the task, a detailed description of the method by which the task was constructed, and the procedure and directions employed in administering the task to the subject.

The Rote Learning Non-Verbal Task

The letter-digit substitution task employed by Johnson (8) was altered to conform to the task criteria. It involved the paired associate method. The following is a reproduction of the first trial.

Trial 1

Key--Stimuli Responses

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

H	I	D	H	B	I	H	D	G

D	B	G	B	H	F	D	G	H

A	D	F	G	C	D	C	B	I

G	I	E	A	C	B	F	A	H

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[1] The number of responses measure was obtained in the following manner. If the subject supplied the correct syllable in less than 4 responses, he was credited with that number. If he made more than 4 responses, he was credited with 4. If he made no responses, he was credited with 4. Therefore, the maximum number of responses score possible was 20.

The subject's task was to learn the 9 letter-digit stimulus response pairs. He proceeded by referring to the demonstration key as often as necessary and writing the correct responses in the blanks under each stimulus.

Each trial was contained on a separate page. One trial at a time was presented to the subject and he responded by writing the digits. One trial consisted of 8 presentations of each stimulus. The subjects committed a minimum of errors and these were pointed out after each trial.

Eighteen trials constituted the task. The key demonstrating the stimulus-response pairs was presented in the same form on every trial over the 18 trials. The order in which the stimuli were presented was varied in an irregular fashion.

The performance measure was the time required to complete each trial.

Appendix F consists of the materials used in the example and the total 18 trials of the task, a description of the methods employed in the task construction, and the procedures and directions utilized to administer the task to the subject.

The Concept Formation Verbal Task

The CFV was based upon the principles and techniques used by Hull (7) and by Heidbredder (4) in their studies of concept formation. The paired associate method was used. Trial 1 is cited for illustration.

Trial 1	Category Name	Response Alternates			
a	sebi	banana	church	six	radio
b	mufa	face	carpenter	pine	chapter
c	bafo	pheasant	page	drum	calf

The subject was required to develop or learn three concepts. These involved the association of three nonsense syllable names with three categories or classes of common nouns: viz, bafo--animals, sebi--numbers, mufa--parts of people.

The investigator showed the subject a card containing one item and read aloud the category name and the four object nouns. The subject had to discover which noun belonged to the class represented by the category name. He began by guessing. The investigator verbally designated the responses as correct or incorrect. After the subject made a correct selection, the next item was initiated.

There were 24 trials in the task. The category names remained the same. The object nouns were changed every trial. An irregular order was utilized in the vertical placement of the category names and in the horizontal placement of the correct object nouns.

The performance measures were the number of responses required per trial to make the three correct selections and the time required to complete each trial.

Appendix G contains the task materials, a description of the procedures utilized in constructing the task, and the procedure and directions employed in administering the task to the subject.

The Concept Formation Non-Verbal Task

The Woodworth-Wells Substitution task (20) was the model on which the CFN was constructed. The paired associate procedure was utilized. The following is a representation of Trial 1.

Trial 1

Key--Category, Symbol, Class Objects	__+__ a	__=__ -a-	__)__ 6	__✓__ -6-
	_____ f	_____ 2	_____ p	_____ -3-
	_____ 3	_____ -5-	_____ -w-	_____ -x-
	_____ -e-	_____ j	_____ 4	_____ 8
	_____ -9-	_____ -y-	_____ -6-	_____ v
	_____ 5	_____ -u-	_____ -g-	_____ -4-
	_____ -7-	_____ -a-	_____ -4-	_____ -7-
	_____ a	_____ b	_____ 9	_____ -k-

The subjects were required to learn to associate the 4 category symbols with the 4 classes of stimuli. Respectively, these were + --letters, = --struck through letters,) --numbers, and ✓ --struck through numbers.

Each trial was presented on a separate page. The subject was exposed to one trial at a time. He referred to the key and wrote the correct category symbol in the blank preceeding the class stimulus. Errors were few but these were called to the subject's attention at the end of each trial.

The task consisted of 18 trials. In each trial, there were 7 representatives of each of the 4 categories of material. These class representatives and their position in the series were changed every trial. The demonstration key remained the same throughout the 18 trials.

The performance measure was the time required to complete each trial.

Appendix H includes a complete presentation of materials employed in the example and 18 trials, a description of the procedures employed in constructing the task, and the directions and procedures used to administer the task to the subject.

Conditions of Reinforcement

The 288 subjects performed each of the 6 tasks under 3 overlapping conditions of reinforcement. These conditions or treatments were designated as type of reinforcement, frequency of reinforcement, and orientation of reinforcement and were administered within the framework of the level of aspiration technique. Briefly, the study involved 2 pairs of control subgroups and 8 experimental subgroups within each of the 3 intelligence groups: retarded, normal, and superior. The subjects in one pair of control subgroups received speed and accuracy directions and information concerning the response measures related to their performance. The subjects in the second pair of control subgroups received the speed and accuracy directions, set levels of aspiration, and received information concerning the response measures related to their performance which became success and failure information depending on what actually occurred within the level of aspiration-performance sequence. The 8 experimental subgroups received the speed and accuracy directions, set levels of aspiration, and received different frequencies of false success and/or failure information oriented within either the individual or the group frame of reference.

Definition of Terms

For the purposes of this investigation, the following definitions of terms were employed in reference to the conditions of reinforcement.

1. Level of aspiration technique--Technique in which the subject was required to make estimates of what his subsequent performance would be after his previous performance had been described to him.
2. Type of reinforcement (C)
    a. Success. Attainment by the subject of a performance score (time) which was equal to or less than the score set by him as his goal.
    b. Failure. Attainment by the subject of a performance score (time) which was more than the score set by him as his goal.

3. Frequency of reinforcement (C)--The proportion of the total number of trials on which success or failure information was given to the subject.

4. Orientation (D)

    a. Individual. Success and/or failure information framed within the context of subject's own performance on previous trials.

    b. Group. Success and/or failure information framed within the context of the performance of other children (boys and girls) in the subject's age group.

Procedure for Administration

Two diagrams will facilitate exposition of the procedures employed in administering the conditions of reinforcement. Figure 2 represents the basic paradigm of the investigation; it serves to illustrate the overlapping dimensions of the 3 conditions of reinforcement and the 12 subgroups[1] thereby defined. Reference to this figure reveals that 3 types of direction and 6 types of performance information were required. The reinforcement schedule is summarized in Figure 3. This schedule includes the timing of the use of these several sets of directions and performance information with the several subgroups.

Directions and Performance Information

As stated previously, 3 sets of directions and 6 types of performance information were necessary. The directions included the task instructions, the speed and accuracy instructions, and the level of aspiration instructions. The sets of performance information consisted of those given in each of the following types of situations: speed and accuracy control, level of aspiration control, success--individual, success--group, failure--individual, and failure--group. The task directions are included in Appendices C through H. The remaining types of directions and performance information are discussed below.

Speed and accuracy directions.--Instructions for accuracy were administered within the framework of the specific task directions (Appendices C through H). These were stated again in combination with the directions for speed which were given at the end of the task directions and at the beginning of each trial. The following are the models used. Although the essence remained

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[1] For the remainder of the discussion the procedure will be described in terms of the 12 subgroups. It must be remembered there were 12 corresponding subgroups in each intelligence group and identical procedures were employed for subjects within the respective subgroups of each intelligence group.

(D)	(C) Type-Frequency	C1 100 Percent Success	C2 66 Percent Success-33 Percent Failure	C3 33 Percent Success-66 Percent Failure	C4 100 Percent Failure	C5 Level of Aspiration Control	C6 Speed and Accuracy Control
Orientation	D1 Individual	(C1D1)	(C2D1)	(C3D1)	(C4D1)	(C5D1)	(C6D1)
	D2 Group	(C1D2)	(C2D2)	(C3D2)	(C4D2)	(C5D2)	(C6D2)

Fig. 2.—Basic Paradigm of the Investigation.[a]

[a] C1D1: 100 percent success—individual orientation
C1D2: 100 percent success—group orientation
C2D1: 66 percent success, 33 percent failure—individual orientation
C2D2: 66 percent success, 33 percent failure—group orientation
C3D1: 33 percent success, 66 percent failure—individual orientation
C3D2: 33 percent success, 66 percent failure—group orientation
C4D1: 100 percent failure—individual orientation
C4D2: 100 percent failure—group orientation
C5D1: Level of aspiration control—no orientation
C5D2: Level of aspiration control—no orientation
C6D1: Speed and accuracy control—no orientation
C6D2: Speed and accuracy control—no orientation

Phase	(1) Trial	Experimental Groups[a]					Control Groups	
		(2) Am't±LA	(3) C1 (D1,D2)	(4) C2 (D1,D2)	(5) C3 (D1,D2)	(6) C4 (D1,D2)	(7) C5	(8) C6
I[b]	1 2	All groups: speed and accuracy directions; reported scores.						
II	1	±5	S	S	F	F	Speed and accuracy directions. Level of aspiration directions. Reported scores.	Speed and accuracy directions. Reported scores.
	2	±7	S	S	F	F		
	3	±4	S	S	S	F		
	4	±6	S	F	F	F		
	5	±6	S	F	F	F		
	6	±4	S	S	S	F		
	7	±7	S	S	S	F		
	8	±5	S	F	F	F		
	9	±4	S	S	F	F		
	10	±6	S	S	F	F		
	11	±5	S	S	S	F		
	12	±7	S	F	F	F		
III	1	-5	S	S	S	S		
	2	-6	S	S	S	S		
	3	-6	S	S	S	S		
	4	-7	S	S	S	S		

Fig. 3.—Reinforcement Schedule.

[a] During Phases II and III, speed and accuracy directions and level of aspiration directions were administered to these subjects. The cited material refers to the additional type and frequency of success or failure information which was framed within the individual or group orientation depending upon the specific C x D combination.

[b] Phase I included 2 trials for the 3 non-verbal tasks and 8 trials for the 3 verbal tasks.

the same, these comments were paraphrased from trial to trial in order to preclude undue repetition of the same words.

> (After task directions) "Now you know what to do. You are to try to get them all right as quickly as you can. Sometimes your teacher may ask you to work as fast as you can or to do as many as you can. Then you try to get all of the problems right as fast as you can. Well, that's what you are supposed to do with this test. The faster you do them right, the better score you make."
>
> (Subsequent trials) "Here is the next trial. Remember, you are supposed to get all of the problems right as fast as you can. The less time you take, the faster you are, and the faster you do the problems right, the better score you get."

Level of aspiration directions.--The levels of aspiration were set within the framework of the time in seconds required to complete a trial accurately. The emphasis was on the score the subject thought he could make and thus that he was going to try to make. Paraphrased versions of the following model were used.

> (After speed and accuracy directions) "Now you know what to do. On each trial, you have tried to get all of the problems right as fast as you could. In other words, you tried to take as little time as possible to do them all right. And the faster you have done them, the better your score has been. Now, I want to tell you something else. Do you know what a goal is? A goal is something you try to do, something you think you should be able to do, so you work for it. For instance, when you play ball/hop scotch you try to win the game. Your goal is to win. Or, when you do arithmetic you try to get as many problems right as you can. Each day you try to do better; for example, your goal is to work more and more problems right. What is another goal you work for in your class? (Discuss with the subject some goal connected with his classroom activities.) That's the idea. A goal is something you try to do, something you work for. You know with these problems you have been working here, you have been trying to get them all right as fast as you could. That was your goal. In other words, you were trying to make as good a score as possible. And each trial you have been trying to do better, to improve your score by getting the problems all right as fast as you could. Now, on the rest of these trials, I want you to tell me what your goals are. I want you to figure out what score you are trying to make. In other words, I want you to tell me how many seconds it's going to take you to do all of the problems right, how fast you are trying to do all of the problems right. Your score on the last trial was ______ seconds. You got all of the right answers in ______ seconds. What score are you going to try for on trial ______ ? How fast are you going to try to do it? How many seconds will it take you to get all of the problems right during the next trial?"

(Subsequent trials: After speed and accuracy directions) "Now, your score on that last trial was ______ seconds. What score are you going to make next time? In how many seconds are you going to get all of the next problems right?"

Performance information--speed and accuracy control.--In the verbal tasks, information about accuracy was given after every response; in the non-verbal tasks, at the end of the trial. Information about speed was given at the end of each trial. The actual time required to complete a trial successfully was designated as the attainment time. This was recorded and used as a performance measure in the analyses of results. However, because of the nature of the procedures employed with the high frequency success groups, it was possible in the cases of some subjects to exhaust the units in the time continuum. It was necessary to minimize the likelihood of such an occurrence because success and failure were administered within the context of time; therefore, an arbitrary constant of 100 seconds was added to the subject's actual attainment time. This derived score, designated the reported time or reported score, was utilized in all tasks except the RLV; here, 150 seconds was added to the attainment time.

These reported times were represented to the subjects as scores. As scores, they were emphasized as reflectors of adequacy of performance. By the nature of the response measure, low scores were associated with relatively superior performance and high scores with relatively inferior performance.

The following types of comments were utilized in relaying performance information to subjects in all subgroups during Phase I of the tasks and to the subjects in the speed and accuracy control subgroups during the entire task.

(*Phase I, all subgroups*; *Phases I, II, and III, speed and accuracy control subgroups*: *CSD1*, *CSD2*). "That trial took you ______ seconds (reported score). Your score was ______ seconds. You got them all right in ______ seconds."

Performance information--level of aspiration control.--The performance information given to the subjects in the level of aspiration control subgroups was essentially the same as that given to the subjects in the speed and accuracy control situations; i.e., they were told their reported times which were the actual attainment times plus 100 seconds (or 150 seconds for the RLV). However, there was one difference. Their score for each trial was related to the goal they set for that trial. The following comments represent the general format of the information given to the subjects.

(*Phases II and III, level of aspiration control subgroups*: *OSD1*, *OSD2*) "You said that your goal for that trial was ______ seconds (level of aspiration time). You were trying to get all of the problems right in ______ seconds. Actually, it took you (less or more) time than that. It took you ______ seconds (reported score)."

Performance information--success and failure.--Success or failure (as defined) was ensured for the subjects in the 8 experimental subgroups by adding or subtracting arbitrarily specified numbers of seconds from their levels of aspiration and relaying these times to them as scores. Listed in column 2 of Figure 3 are the amounts of seconds added or subtracted each trial. On success trials, the specified time was subtracted from the level of aspiration time set by the subject for that trial and he was told that he performed the trial in less time than he thought he could; thus, he made a better score than that set by him as his goal. On the failure trials, the specified time was added to the subject's level of aspiration time and he was informed that the trial performance required more time than he thought it would; hence, he made a worse score than that indicated by him as his goal. In selecting these amounts of time to be added or subtracted, it was decided arbitrarily that the amount or size of the alterations of the levels of aspiration would be within the limits of 4 to 7 seconds. The 4 digits were arranged so they would occur with equal frequency but in irregular order over the 16 trials in which false success or failure information was furnished. Once established, this system of order and amount was used for all of the subjects and for all of the tasks.

In columns 3 through 6 of Figure 3 appear designations of the type of success and/or failure information the subjects in each subgroup received on each trial and thus is specified the set of performance information used. It will be remembered that the subjects in the C2 and C3 subgroups received differential frequencies of success and failure information. For the C2 subgroups, 4 of the 12 trials in Phase II were designated failure trials; the remaining 8 trials were success trials. For the C3 subgroups, 8 of the 12 trials were selected as failure trials with the remaining 4 trials being success trials. Once so determined, these designations were used for all of the subjects in these subgroups and for all of the tasks.

The success or failure information administered to the subjects was contained within two frames of reference. The first was designated the individual orientation; the second, the group orientation. In the individual orientation, the subject's performance on each trial was compared to his performance on the previous trials. Conversely, in the group orientation, the subject's performance on each trial was compared to that of others in the same sex and chronological age groups.

The models for the 4 sets of performance information employed with the subjects in the success and failure subgroups are cited below.

> (*Phase II, success--individual orientation subgroups: C1D1, C2D1, C3D1; Phase III, all D1 subgroups*) "You said that your goal for that trial was ______ seconds (level of aspiration time). Actually, it took you less time that that. It took you ______ seconds (level of aspiration time minus specified time).

"That's faster than you said you could do it. That's a better score than you said you could make. You did better than you thought you would do.

"In fact, you did better on that trial than you have been doing on most of the other, past trials. In other words, you were able to do all of the problems right faster than you were able to do them on most of the other, past trials. You are beating the scores you made on the other trials."

(Phase II, success--group orientation subgroups: C1D2, C2D2, C3D2; Phase III, all D2 subgroups) "You said that your goal for that trial was _____ seconds (level of aspiration time). You were trying to get all of the problems right in _____ seconds. Actually, it took you less time than that. It took you _____ seconds (level of aspiration time minus specified time).

"That's faster than you said you could do it. That's a better score than you said you could make. You did better than you thought you would do.

"In fact, you did better on that trial than most (boys-girls) your age can do. In other words, you were able to do all of the problems right faster than most (boys-girls) your age are able to do. You are beating the scores made by other (boys-girls) your age."

(Phase II, failure--individual orientation subgroups: C2D1, C3D1, C4D1) "You said that your goal for that trial was _____ seconds (level of aspiration time). You were trying to get all of the problems right in _____ seconds. Actually, it took you more time than that. It took you _____ seconds (level of aspiration time plus specified time).

"That's slower than you said you could do it. That's not as good a score as you said you could make. You did not do as well as you thought you would do.

"In fact, you did not do as well on that trial as you have been doing on most of the other, past trials. In other words, you were not able to do all of the problems right as fast as you were able to do them on most of the other, past trials. You are not beating the scores you made on the other trials."

(Phase II, failure--group orientation subgroups: C2D2, C3D2, C4D2) "You said your goal for that trial was _____ seconds (level of aspiration time). You were trying to get all of the problems right in _____ seconds. Actually, it took you more time than that. It took you _____ seconds (level of aspiration plus specified time).

"That's slower than you said you could do it. That's not as good a score as you said you could make. You did not do as well as you thought you would do.

"In fact, you did not do as well on that trial as most (boys-girls) your age can do. In other words, you were not able to do all of the problems right as fast as most (boys-girls) your age are able to do. You are not beating the scores made by other (boys-girls) your age."

Reinforcement Schedule

The reinforcement schedule was employed as a guide for the timing of the use of the several sets of directions presented above. This schedule is illustrated in Figure 3. The materials included in the Figure may be explained as follows. The administration of the total number of trials of a task consisted of three possible phases. During Phase I, all of the subjects were administered the directions related to speed and accuracy and performance information in the form of the reported time score. There were two purposes for this phase. First, it furnished the subjects a base for setting their levels of aspiration. Second, it enabled the investigators to obtain a measure of the subjects' initial performance level which was necessary for the analyses of results.

During Phases II and III, the subjects in the speed-accuracy control subgroups (C6D1, C6D2) continued to perform under only these directions and be told their reported scores (actual attainment time plus 100 or 150). The subjects in the other subgroups received these directions alone and this type of performance information for only a selected number of trials. Since performance increments were more rapid in the non-verbal tasks, Phase I included only 2 trials. For the verbal tasks, more initial practice was required before apparent performance increments occurred; therefore, Phase I consisted of 8 trials.[1]

During Phase II, in addition to the speed and accuracy directions, the subjects in the subgroups C1 through C5, D1 and D2 were administered the level of aspiration and differential success-failure sequences. This phase consisted of 12 trials. The first level of aspiration was set at the final trial of Phase I (trials 2 and 8 for the non-verbal and verbal tasks, respectively) and pertained to the first trial of Phase II (trials 3 and 9 for the two types of tasks, respectively).

At the end of the third or ninth trial, the level of aspiration control subgroups (C5D1, C5D2) were told their reported scores (actual attainment time plus 100 or 150). These 2 control subgroups continued to perform under these conditions during Phases II and III; i.e., at the beginning of the trial, they received the speed and accuracy directions and set levels of aspiration and at the end of the trial they were given their reported scores.

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[1] These statements are based upon the analyses of the pilot test data.

At the end of the third or ninth trial, the arbitrary success or failure information (levels of aspiration plus or minus the specified time) was presented to the subjects in the experimental subgroups. This procedure, the administration of differential frequencies of success and failure information to the several subgroups, was continued throughout the 12 trials of this phase. Reference to Figure 2 (columns 3 through 6) reveals the type of performance information administered to each subgroup on each trial. The 100 percent success subgroups (C1D1, C1D2) received success information at the end of each of the 12 trials. The 100 percent failure subgroups (C4D1, C4D2) received failure information on these trials. The 66 percent success-33 percent failure subgroups (C2D1, C2D2) received success information on 8 of the 12 trials and failure information on 4; conversely, the 66 percent failure-33 percent success subgroups (C3D1, C3D2) were given failure information at the end of two-thirds of the 12 trials and success information after one-third.

Phase III included the administration of 4 terminal trials in which all of the experimental subgroups received success information. (The 2 pairs of control groups continued to receive the reported scores.) The purpose of this phase was twofold. First, it ensured that each experimental subject terminated his participation in the task with a substantial success experience. Second, performance data obtained on these trials were necessary for the evaluation of the effect of change of reinforcement on the subjects' responses; that is, the relationship between Phases II and III as well as that between Phases I and II.

The information contained in Figures 1 and 2 and discussed in detail above is summarized below in terms of the specific procedure followed with each of the 12 subgroups.

C1D1: 100 percent success--individual orientation.

Phase I--Speed and accuracy directions, reported scores.

Phase II--Speed and accuracy directions, level of aspiration directions, success information framed within the individual orientation on each of the 12 trials of this phase.

Phase III--Speed and accuracy directions, level of aspiration directions, success information framed within the individual orientation on each of the 4 trials.

C1D2: 100 percent success--group orientation.

Phase I--Speed and accuracy directions, reported scores.

Phase II--Speed and accuracy directions, level of aspiration directions, success information framed within the group orientation on each of the 12 trials of this phase.

Phase III--Speed and accuracy directions, level of aspiration directions, success information framed within the group orientation on each of the 4 trials.

C2D1: 66 percent success, 33 percent failure--individual orientation.

Phase I--Speed and accuracy directions, reported scores.

Phase II--Speed and accuracy directions, level of aspiration directions, success information framed within the individual orientation on trials 1, 2, 3, 6, 7, 9 10, and 11 of this phase and failure information framed within the individual orientation on trials 4, 5, 8, and 12 of this phase.

Phase III--Speed and accuracy directions, level of aspiration directions, success information framed within the individual orientation on each of the 4 trials.

C2D2: 66 percent success, 33 percent failure--group orientation.

Phase I--Speed and accuracy directions, reported scores.

Phase II--Speed and accuracy directions, success information framed within the group orientation in trials 1, 2, 3, 6, 7, 9, 10, and 11 of this phase and failure information framed with the group orientation on trials 4, 5, 8, and 12 of this phase.

Phase III--Speed and accuracy directions, level of aspiration directions, success information framed within the group orientation on each of the 4 trials.

C3D1: 33 percent success, 66 percent failure--individual orientation.

Phase I--Speed and accuracy directions, reported scores.

Phase II--Speed and accuracy directions, level of aspiration directions, success information framed within the individual orientation on trials 3, 6, 7, and 11 of this phase and failure information framed within the individual orientation on trials 1, 2, 4, 5, 8, 9, 10, and 12 of this phase.

Phase III--Speed and accuracy directions, level of aspiration directions, success information framed within the individual orientation on each of the 4 trials.

C3D2: 33 percent success, 66 percent failure--group orientation.

Phase I--Speed and accuracy directions, reported scores.

Phase II--Speed and accuracy directions, level of aspiration directions, success information framed within the group orientation on trials 3, 6, 7, and 11 of this phase and failure information framed within the group orientation on trials 1, 2, 4, 5, 8, 9, 10, and 12 of this phase.

Phase III--Speed and accuracy directions, level of aspiration directions, success information framed within the group orientation on each of the 4 trials.

__C4D1__: __100 percent failure--individual orientation.__

Phase I--Speed and accuracy directions, reported scores.

Phase II--Speed and accuracy directions, level of aspiration directions, failure information framed within the individual orientation on each of the 12 trials of this phase.

Phase III--Speed and accuracy directions, level of aspiration directions, success information framed within the individual orientation on each of the 4 trials.

__C4D2__: __100 percent failure--group orientation.__

Phase I--Speed and accuracy directions, reported scores.

Phase II--Speed and accuracy directions, reported scores, failure information framed within the group orientation on each of the 12 trials of this phase.

Phase III--Speed and accuracy directions, level of aspiration directions, success information framed within the group orientation on each of the 4 trials.

__C5D1 and C5D2__: __Level of aspiration control--no orientation.__

Phase I--Speed and accuracy directions, reported scores.

Phase II--Speed and accuracy directions, level of aspiration directions, reported scores.

Phase III--Speed and accuracy directions, level of aspiration directions, reported scores.

__C6D1 and C6D2__: __Speed and accuracy control--no orientation.__

Phase I--Speed and accuracy directions, reported scores.

Phase II--Speed and accuracy directions, reported scores.

Phase III--Speed and accuracy directions, reported scores.

Task Schedule

The above presented procedures for administering the conditions of reinforcement were utilized with each of the 6 tasks. It was desirable to ensure that a subject did not perform more than one task under any specific combination of conditions. To do so, the 6 type-frequency (C) conditions were arranged in irregular order for each base cell group so that no group was administered a condition more than once. The two orientation (D) conditions were alternated so that each group performed under the D1 condition on 3 tasks and under the D2 condition on 3 tasks.

Listed below are the irregular orders of the C conditions used for base cell groups 1 to 6 and 7 to 12.

Task	Base Cell Groups 1 to 6						Base Cell Groups 7 to 12					
	C1	C2	C3	C4	C5	C6	C1	C2	C3	C4	C5	C6
1	1	2	3	4	5	6	7	8	9	10	11	12
2	3	5	6	1	2	4	10	7	8	9	12	11
3	2	6	1	3	4	5	11	10	12	8	7	9
4	4	1	2	5	6	3	9	11	10	12	8	7
5	6	4	5	2	3	1	12	9	7	11	10	8
6	5	3	4	6	1	2	8	12	11	7	9	10

Base cell groups 1 to 6 were in the D1 condition on tasks 1, 3, and 5 and in the D2 condition on tasks 2, 4, and 6. This was reversed for base cell groups 7 to 12. The conditions to which the subjects in each base cell group were exposed as they performed in the several learning situations become more apparent when the material is rearranged according to tasks. The resulting task schedule is presented in Figure 4.

General Procedure

The 6 tasks were administered individually to the 288 subjects. One task was administered to a subject in a single session. In most cases, these sessions required 45 minutes to 1 hour and all occurred during the school day. The investigator met the subject in a private room within the school; these rooms were free from excessive or unusual noise and interruption during the task administration.

An individual schedule sheet was prepared for each subject. In addition to subject data, the schedule sheet contained information about the combination of conditions under which the subject

Base Cell Groups	Tasks						
	DLV (1)	RLV (2)	CFV (3)	DLN (4)	RLN (5)	CFN (6)	
1	C1D1	C4D2	C3D1	C2D2	C6D1	C5D2	Conditions
2	C2D1	C5D2	C1D1	C3D2	C4D1	C6D2	
3	C3D1	C1D2	C4D1	C6D2	C5D1	C2D2	
4	C4D1	C6D2	C5D1	C1D2	C2D1	C3D2	
5	C5D1	C2D2	C6D1	C4D2	C3D1	C1D2	
6	C6D1	C3D2	C2D1	C5D2	C1D1	C4D2	
7	C1D2	C2D1	C5D2	C6D1	C3D2	C4D1	
8	C2D2	C3D1	C4D2	C5D1	C6D2	C1D1	
9	C3D2	C4D1	C6D2	C1D1	C2D2	C5D1	
10	C4D2	C1D1	C2D2	C3D1	C5D2	C6D1	
11	C5D2	C6D1	C1D2	C2D1	C4D2	C3D1	
12	C6D2	C5D1	C3D2	C4D1	C1D2	C2D1	

Fig. 4.--Task Schedule.

performed each task. The material cited in Figure 5 is a representative example.

Subject Code Number B1-5 Subject Name (deleted)

Base Cell Group 4 Teacher (deleted)

Subject Number in Base Cell Group 5 School (deleted)

Task	DLV	RLV	CFV	DLN	RLN	CFN
Conditions	C4D1	C6D2	C5D1	C1D2	C2D1	C3D2
Date Administered						
Administrator						

Fig. 5.--Subject Schedule.

The exigencies of the research situation precluded the counterbalanced order of task administration which would have been desirable for maximum control in an investigation of the present type. Therefore, the following order of task administration was utilized. The first task to be administered was the RLN. When about one-half of the RLN were administered, the DLV and the DLN were initiated. When the majority of these tasks were administered, the RLV and CFN were introduced. When most of the latter tasks were administered, the CFV was started. During the overlapping periods of task administration, the respective tasks were presented interchangeably.

The subjects attended 23 different schools[1] located within a radius of 50 miles. Ten different investigators administered tasks regularly during a 4 1/2 month period. No systematic orders of schools, conditions of reinforcement, or subjects were employed. Rather, within any two-week period, investigators worked in all schools administering tasks under the several conditions of reinforcement to retarded, normal, and superior subjects. In most cases, there was an interval of at least 2 or more weeks between the administration of any 2 tasks to a subject. In additfon, although because of necessity it sometimes was impossible, every effort was made to schedule so that one investigator did not present 2 consecutive tasks to any one subject.

Plan for the Analyses of Results

Inspection of the problems listed for investigation will reveal that four aspects of the subjects' behavior were selected for scrutiny. These included learning performance, level of aspiration responses, psychometric task performance, and achievement test performance.

The pertinent response measures were the following: learning performance--the attainment time and the number of responses scores related to the six experimental tasks (DLN, DLV, RLN, RLV, CFN, CFV); level of aspiration responses--the absolute, positive, and negative goal discrepancy scores and the frequencies with which the subjects changed their goals in the several directions after attainment or non-attainment of their immediately preceding goals related to performance on the six experimental tasks; psychometric task performance--the frequencies with which the subjects passed or failed the several individual sub-tests of the 1937 Revision of the Stanford-Binet Test of Intelligence, Form L. The response measures pertinent to achievement test performance were reading vocabulary grade placement, reading comprehension grade placement, total reading grade placement on the California Achievement Tests: Upper Primary and Elementary Batteries, Form W. Basically, the comparisons of the subjects involved within-groups variances, means, and frequencies. Discussed below are the procedures utilized in making these comparisons.

A score sheet used with the verbal tasks is included for illustration of the several types of scores related to the experimental tasks (Figure 6).[2] The response measures reflecting learning

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[1] During the organization of the record-keeping and scheduling procedures, the several schools in the smaller school systems were grouped according to location and each school system was assigned one school code number, consequently, the upper limit of the school code numbers and the number of schools cited above are not equal.

[2] The score sheets employed with the other tasks were essentially the same as the one presented.

Name___________________________ S. Code #________________________

School - Grade_______________________ Task_____________________________

Date___________________________ Exp. Conds._______________________

1 Trial	2 Amt ±	3 C2	4 C3	5 #R	6 Att. Time	7 LA Prev Tr'l	8 Rep. Time	9 LA Next Tr'l	10 G.D. & Sign (8-9)	11 (Frequency Meas.) Resp. to Suc: Fail. 7:S : : LA : LA S:R	S:L	F:R	F:L	F No chg.	S No chg.
1															
2															
3															
4															
5															
6															
7															
8															
9	±5	S	F												
10	±7	S	F												
11	±4	S	S												
12	±6	F	F												
13	±6	F	F												
14	±4	S	S												
15	±7	S	S												
16	±5	F	F												
17	±4	S	F												
18	±6	S	F												
19	±5	S	S												
20	±7	F	F												
21	-5	C1	C2												
22	-6	C3	C4												
23	-6	All													
24	-7	Success													

Fig. 6.--Score Sheet--*Verbal* *Tasks*.

performance are located as follows: time scores (actual attainment time) are in Column 6 and the number of responses scores are in Column 5. The level of aspiration measures--the goal discrepancy scores and frequencies related to direction of goal changes after success and failure--are based on the information listed in Columns 8-11. The goal discrepancy score (Column 10) was computed in the conventional manner--subtracting the reported performance time for a trial (Column 8) from the level of aspiration (Column 9) set for that trial. Because levels of aspiration were set in terms of time and relatively high goals were reflected by relatively low time scores and vice versa, the subtractive procedure was reversed so that goals higher than the performance level would be associated with a positive sign and goals lower than the performance level, with a negative sign. The frequency measures reflecting direction of goal changes were computed in six categories (Column 11): raising the goal after success, lowering after success, raising after failure, lowering after failure, no change after success, and no change after failure. Direction of goal change was computed by subtracting the level of aspiration set for a trial from that set for the immediately preceding trial (Column 10). Positive remainders reflected raised goals (in the case of time scores); negative remainders, lowered goals; and zero remainders, no change in goals. On the basis of the relationship between the remainder thus obtained and the observation whether success or failure occurred on a trial (Columns 7-8), the digit one was entered into the appropriate category.

The subjects' attainment time scores, number of responses scores, and absolute (sign ignored), positive, and negative goal discrepancy scores were evaluated in terms of inter-individual variability and central tendency. Four factors were of interest: B, intelligence (3 levels or groups); D, orientation (2 groups); C, type-frequency (6 or 5 groups);[1] and A, trials (4 sections). The following diagram perhaps may clarify the manner in which the trials of the verbal and non-verbal tasks were divided into the four sections for the several response measures:

	Phase I	Phase II	Phase III
Non-verbal tasks	Trials 1-2	Trials 3-14	Trials 15-18
Verbal tasks	Trials 1-8	Trials 9-20	Trials 21-24

In the exposition of the procedure for administering the reinforcement conditions, it was explained that Phase I involved the subjects' performance on a task without experimental manipulation of reinforcement. Goals were set on trials 2 and 8 for the non-verbal and verbal tasks, respectively. Differential success and failure information were administered during the twelve trials of Phase II, and all success information was administered during the trials of Phase III. For the statistical analyses related to the A (trials) factor, this division of trials was followed; in addition, Phase II was divided into two equal parts. Consequently, the trials were grouped as follows: section 1 for attainment times and number of responses scores, all of the trials of Phase I and for the goal discrepancy scores, the last trial of Phase I; section 2, for all measures, the first six trials of Phase II;

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[1] Comparisons in times of learning performance involved six type-frequency groups; comparisons in times of level of aspiration responses, five type-frequency groups. In other words, the speed and accuracy control groups (C6) were not involved in the level of aspiration comparisons.

section 3, for all measures, the second six trials of Phase II; section 4, for all measures, all of the trials of Phase III.

The Bartlett test of homogeneity of variance was used to evaluate the relationships among the within-groups variability of the subjects' scores. Analyses[1] were performed relevant to the four factors--B, D, C, A--for the total group of 288 subjects. Parallel analyses were made within each of the intelligence level groups (B) pertinent to the three factors--D, C, and A. The criterion for the rejection of the null hypothesis was the .01 level of probability.

The three groups of subjects differed in terms of MA. One of the main interests of this investigation was the response of subjects who were equivalent in terms of MA and different in terms of IQ and CA; therefore, the possibility of employing the analysis of covariance technique in examining relative central tendencies in the subjects' responses to the experimental tasks was considered. However, in many comparisons the subjects differed in terms of homogeneity of variance; further, there were not sufficient grounds to rationalize conclusively that, in the framework of the complex experimental design employed, the important assumptions of linearity and homogeneity of regression could be satisfied. As a result, in view of the danger of violating some of the assumptions or conditions upon which valid use of the covariance technique is based, and in view of the excessive amount of additional expensive and laborious statistical work which would be required, it was decided to forego the more complex analyses and substitute logical consideration for statistical control.[2] Therefore, a four factor analysis of variance design was employed as a statistical test of the relationships among the means of the scores. The model selected was based upon the one designated by Lindquist (10) as the Type III design.[3] The A factor was the repeatable or trend factor. The criterion for rejection of the null hypothesis was the .01 level of probability. The reasoning[1] underlying this decision was the following. To some extent, the response measures were limited in precision; on the other hand, the large number of subjects and the statistical design employed resulted in highly powerful or precise statistical tests. Consequently, there was a possibility that the results would reflect statistical but not practical significance. In addition, since so many tests were being performed, it could be expected that the number of ostensibly significant statistics occurring by chance would be magnified. To attenuate the possibility of these difficulties, it was decided, *a priori*, to adopt a higher probability level than the .05 level which conventionally is selected.

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[1] Much of the data processing was accomplished by utilizing IBM machines. Appendix I consists of pertinent programs.

[2] Subsequent support for this decision was obtained from two sources. First, the use of analysis of covariance did not change appreciably the results obtained by the application of analyses of variance to the achievement test scores. This result was considered to suggest that the differences in MA which did occur were not related to the differences which were evident in the criterion scores. Second, the pattern of relationships isolated in the application of analyses of variance to the experimental task scores were consistent with this conclusion. Further, there was no a priori reason to believe that the small difference in MA which occurred would affect, to any great extent, the level of aspiration response measures.

[3] Much of the data processing was accomplished by utilizing IBM machines. Appendix I consists of pertinent programs.

When the chi square yielded by the Bartlett test occurred at a probability level of .01 or less, the null hypothesis was rejected and it was inferred that extreme heterogeneity of variance was present. In the concomitant evaluation[2] of the differences among means of the scores in which there was such evidence of marked or extreme heterogeneity of variance, the criterion for significance of the F ratio was changed from the probability level .01 to the probability level .001. In other words, when extreme heterogeneity of variance was present, it was considered that it was not possible, without correction, to meet the assumptions upon which valid use of the analysis of variance design employed is based. Therefore, in such cases, allowance or correction was made by adopting the smaller probability level needed for significance.

When the F ratio yielded by the analysis of a main effect proved to be significant, individual *t* tests were employed for scrutiny of the simple effects. That is, when there was evidence of differences among the several means included in any one generalized comparison (B, D, C, A, or the various interactions), subsequent analyses were made of the differences between each pair of means involved.

One further comment is pertinent to this topic. There was consideration of the use of the critical difference technique suggested by Lindquist (10) rather than individual *t* tests for evaluating differences between pairs of means. However, there is questionable validity in employing this device when heterogeneity of variance is present in the scores. Since such heterogeneity occurred so often, consistent use of the technique was not possible. So, it was decided to not vary techniques; the individual *t* tests were employed throughout. If the chi square associated with the main effect was not significant, the criterion for significance of the *t* ratio was the .01 level of probability. If it was, the score variances of the individual groups compared were evaluated by means of the Snedecor F test. If the resulting F ratio proved significant at the .01 level of probability, the adjustment suggested by Cochran and Cox (1) (entering the *t* table with one-half the usual number of degrees of freedom) was used in assessing the probability of the *t* ratio; if the F ratio was not significant, this adjustment was not employed.

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[1] See Edwards (2), Lindquist (10), and McNemar (14) for discussion of the issues involved here.

[2] See Lindquist (10), Edwards (2), and Cochran and Cox (1), for a discussion of the relationship between homogeneity of variance and the shapes of the F distribution and of the *t* distribution.

The directions in which the subjects altered their goals were classified into six categories: after success information--raising, lowering, or not changing goals; after failure information--raising, lowering, or not changing goals. For each trial, the frequencies entered in each category were summarized for each base cell group. From trial to trial, the types of reinforcement information administered to the several groups varied; consequently, direct comparisons of all groups in terms of each category were not possible for each trial. Instead, comparisons were made only of the groups who received the same type of information. These comparisons are listed below.

1. Verbal tasks, trials 9, 10, 17, 18; non-verbal tasks, trials 3, 4, 11, 12: response of C1, C2, and C5[1] groups (all B and D classifications) to success information.
2. Verbal tasks, trials 9, 10, 17, 18; non-verbal tasks, trials 3, 4, 11, 12: response of C3, C4, and C5[1] groups (all B and D classifications) to failure information.
3. Verbal tasks, trials 11, 14, 15, 19; non-verbal tasks, trials 5, 8, 9, 13: response of C1, C2, C3, and C5[1] groups (all B and D classifications) to success information.
4. Verbal tasks, trials 12, 13, 16, 20; non-verbal tasks, trials 6, 7, 10, 14: response of C2, C3, C4, C5[1] groups, (all B and D classifications) to failure information.
5. Verbal tasks, trials 21, 22, 23; non-verbal tasks, trials 15, 16, 17: response of C1, C2, C3, C4, C5[1] groups (all B and D classifications) to success information.

For each trial, the appropriate groups were compared in terms of each category. The procedure was as follows: the frequencies were classified into fourfold contingency tables and evaluated in terms of the methods and minimum contrasts listed by Mainland, Herrera, and Sutcliff (11). The contrasts between the frequencies for the C1, C2, C3, C4 groups (in each of which there were 8 subjects) were compared with those listed by Mainland *et al.* in Table II, "Minimum Contrasts Required in Fourfold Contingency

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[1] It will be remembered that the C5 groups were the level of aspiration control groups and received no arbitrary reinforcement information; whether they received success or failure information was contingent upon the actual relationship between their set goal and their attained performance. As a result, some subjects received success information on a given trial while some received failure information. Thus, in any one comparison, the frequency in these groups quite often did not equal eight.

Tables for Significance at the 1 Percent Level" (11, pp. 5-14). The contrasts between the frequencies for the C5 groups (in which the number of subjects varied) and the C1, C2, C3, and C4 groups, and between the frequencies for any two C5 groups were compared with those listed by Mainland et al. in Table IV, "Minimum Contrasts Required in Fourfold Contingency Tables for Significance at the 1 Percent and 5 Percent Levels--Unequal Samples Up to N=20" (11, pp. 15-22). Even though these statistical tests must be considered of low power, in view of the extremely large number of comparisons made, it was considered wisest to adopt the .01 level of probability as the criterion for significance.

Over the several months that the experimental data were being collected, attrition occurred to a limited extent. Consequently, it was necessary to substitute several subjects[1] to obtain performance data for the remaining tasks. In this process, every effort was made to employ subjects who were as nearly as possible similar in terms of mental age to the subjects for whom they were being substituted. Further analyses of the relative subject characteristics were not performed after each substitution. Because of the large number of original subjects in relation to the small number of substitutes, it was not believed that such analyses would yield results which would differ appreciably from those presented in Tables 1 through 9.

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[1]

Base Cell No.	Substitution		Substituted For	
	Subject Code No.	Tasks Administered	Subject Code No.	Tasks Administered
1	B_1 60	PDN, RLV, CFN, CFV	B_1 18	RLN, PDV
4	B_1 153	PDN, RLV, CFN, CFV	B_1 9	RLN, PDV
5	B_1 117	PDV, PDN, RLV, CFN	B_1 106	RLN
7	B_1 151	PDN, RLV, CFN, CFV	B_1 129	RLN, PDV
2	B_2 112	RLV, CFN, CFV	B_2 74	RLN, PDV, PDN
8	B_3 101	CFN, CFV	B_3 43	RLN, PDV, PDN, RLV
10	B_3 102	PDV, PDN, RLV, CFN, CFV	B_3 63	RLN
11	B_3 104	RLV, CFN, CFV	B_2 12	RLN, PDV, PDN

The procedure utilized in evaluating relative performance on the 1937 Revision of the Stanford-Binet Test of Intelligence, Form L, may be described as follows. The numbers of subjects in the three groups who passed or failed each subtest item were tabulated. For the several comparisons, fourfold contingency tables including the appropriate frequencies were formed. The differences between any two frequencies were evaluated according to the method and minimum contrasts elucidated by Mainland _et al._ (11, pp. 5-14). Several further comments are pertinent. To use this method with large numbers of subjects, it is desirable that there be equal numbers of subjects in each group. Originally, in the present situation, there were not equal frequencies in each comparison because the range of subtests administered to all of the individuals involved, naturally, varied to some extent. Therefore, to make the comparisons an assumption was required. It was assumed that a subject could be considered to have passed every item which occurred below his basal age (the year-level at which he passed all subtests) and to have failed every item which occurred above his upper mental age limit (the year-level at which he failed all subtests). For five subtests, there were not 60 subjects in each group because time pressures necessitated that abbreviated forms of the test be administered to some subjects. Critical ratios for independent proportions (2) were computed in each of the comparisons involving these subtests. Since so many statistical tests were made in this phase of the study, it again was considered feasible to adopt the .01 level as the criterion for rejection of the null hypotheses.

The analysis of covariance technique was selected for the comparison of the groups in terms of the response measures related to achievement--total reading, reading comprehension, and reading vocabulary grade placement on the California Achievement Tests: Upper Primary and Elementary Batteries, Form W. This selection was made for these reasons: first, the superior subjects differed in terms of MA from the other two groups, who, in turn, were homogeneous insofar as MA was concerned; second, there was no reason to believe that heterogeneity of variance, heterogeneity of regression, or other such conditions were present to such an extent that the assumptions upon which valid use of the covariance technique is based would be vitiated. When the F ratios associated with the generalized comparisons proved significant, the adjusted means were computed and the several pairs of these were compared by means of the procedures outlined by Lindquist (10). Here, as in the other analyses, and for similar reasons, the criterion for rejection of the null hypothesis was the .01 level of probability.

One additional comment may be helpful to the reader. In cases in which the degrees of freedom of the F ratios or _t_ ratios to be evaluated did not correspond to the tabled values, Lindquist's (10) suggestion was followed. That is, the _F_ or _t_ for the nearest combination of smaller degrees of freedom was employed.

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CHAPTER III

RESULTS

Learning and level of aspiration data were obtained by administering six tasks under three overlapping conditions of reinforcement to 288 intellectually retarded, normal, and superior subjects. The tasks consisted of verbal and non-verbal forms of situations designed to elicit discrimination learning, rote learning, and concept formation; these were designated respectively as the discrimination learning verbal, the discrimination learning non-verbal, the rote learning verbal, the rote learning non-verbal, the concept formation verbal, and the concept formation non-verbal tasks. The conditions of reinforcement were termed type, frequency, and orientation, and were administered within the framework of the level of aspiration paradigm. The total group of 288 subjects was composed of three groups of subjects categorized according to intellectual level--96 retarded subjects, 96 normal subjects, and 96 superior subjects. Each of these levels groups was sub-divided into treatment groups defined by the conditions of reinforcement. Within each intelligence level, there were twelve sub-groups of subjects defined by the treatment combinations or overlap of the reinforcement conditions. There were eight subjects in each level x treatment x treatment cell. The verbal tasks consisted of 24 trials; the non-verbal tasks, 18 trials. For the purpose of the analyses, these trial sequences were divided into four sections: one section included the initial or control phase (8 trials for the verbal tasks and 2 trials for the non-verbal tasks); two sections, the first and second halves of the administration of reinforcement phase (2 sets of 6 trials for all tasks); and one section, the terminal phase (4 trials for all tasks). The analyses of the results involved a scrutiny of the responses of the different subjects receiving the several treatments and an evaluation of the performance of the same subjects during the several sections of trials. The results of these statistical analyses are presented in this chapter. This presentation is organized in the following manner. Each of the six learning tasks is considered separately; the data discussed are those related to the learning performance and level of aspiration responses of the subjects in the several levels and treatments sub-groups.

In addition to the above information, data were available relevant to psychometric and achievement test performance. For various reasons, the analyses of these data did not include the total 288 subjects. Consequently, the descriptions and comparisons of the groups in terms of MA, CA, and IQ presented in Chapter II do not apply directly to the discussion of the results of these latter analyses. For this reason, data pertinent to the characteristics of the groups of subjects involved in the analyses of psychometric performance and of the groups of subjects involved in the analyses of achievement test performance will be presented in conjunction with the results of the statistical analyses of these two types of performance. Thus, presented as separate units in this chapter are data reflecting responses to each type of task--learning, psychometric, and achievement. In the next chapter, all of these data are summarized and reorganized according to the several topics implicit in the research questions proposed in Chapter I.

Comments about the mechanics of presentation perhaps will be helpful. The analyses of the data related to the subjects' responses to the learning tasks involved a mass of statistical detail. In the interest of brevity and clarity in the presentation of the results, the following adjustments were considered feasible. First, in the tables are listed only rounded numbers (by the conventional procedures); however, it must be realized that unrounded numbers were employed in the statistical analyses. Second, an extremely large number of means were considered in the several comparisons. The tables include only the means of the base cell groups and the means pertinent to the comparisons by which significant statistics were yielded. Not presented are the means scrutinized in the analyses (of the main effects and the first and second order interactions) which did not result in significant F ratios. Since means are additive, it is considered that the reader can compute any of these central tendencies in which he has a special interest. Third, tables consisting of summaries of the results of the several analyses are employed. In the description of the results, reference is made most directly to these tables. The reader interested in more statistical detail may refer to the appropriate individual tables. The presentation of the results of the statistical analyses does not consist of a specific reiteration of the contents of the tables. Rather, an attempt has been made to describe the relationships implied by these statistics. To facilitate the recognition of the relationship between the statistical and verbal content, the alphanumeric symbols and their labels are outlined below.

B, intelligence level: B1, retarded group; B2 normal group; B3, superior group.

D, orientation of reinforcement: D1, individual orientation; D2, group orientation.

C, type-frequency of reinforcement: C1, 100 percent success; C2, 66 percent success, 33 percent failure; C3, 33 percent success, 66 percent failure; C4, 100 percent failure; C5, level of aspiration control; C6, speed and accuracy control.

A, section of trials: A1, trials of the control phase; A2, first half of the trials of the reinforcement phase; A3, second half of the trials of the reinforcement phase; A4, trials of the terminal, 100 percent success reinforcement phase.

BD: level x orientation interaction.

BC: level x type-frequency interaction.

DC: orientation x type-frequency interaction.

BDC: level x orientation x type-frequency interaction.

BA: level x trials interaction.

DA: orientation x trials interaction.

CA: type-frequency x trials interaction.

BDA: level x orientation x trials interaction.

BCA: level x type-frequency x trials interaction.

DCA: orientation x type-frequency x trials interaction.

BDCA: level x orientation x type-frequency x trials interaction.

Discrimination Learning Verbal Task

In Tables 10 through 26 appear the data pertinent to the subjects' learning performance and level of aspiration responses on the DLV. Tables 10, 11, and 12 contain statistics relevant to the attainment time scores; Tables 13, 14, and 15, to the number of responses scores; Tables 16, 17, and 18, to the absolute goal discrepancy scores; Tables 19, 20, and 21, to the positive goal discrepancy scores; and Tables 22, 23, and 24, to the negative goal discrepancy scores. Table 25 is composed of a summary of the results of the statistical analyses. Listed in Table 26 are the data reflecting the frequencies with which the subjects changed their goals in the several directions after they received success or failure information.

Learning Performance

Attainment Time

The data reflecting the interindividual variability of the attainment time scores on the DLV are contained in Table 10 and Column 2 of Table 25. When the responses of the total groups of subjects were examined, between intelligence groups extreme heterogeneity of variance occurred. Similar extreme heterogeneity of variance was manifested in the scores of the subjects in the six different type-frequency groups. On the other hand, the scores of the subjects in the two different orientation groups were

TABLE 10

COMPARISON OF THE GROUPS IN TERMS OF ATTAINMENT TIME: DISCRIMINATION LEARNING VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	383	386	21.546***							
	B2		383	511								
	B3		383	621								
D	D1	1	575	471	2.869	191	355	1.121	455	2.376	596	0.343
	D2		575	542		191	414		570		649	
C	C1	5	191	355	36.809***	63	346	25.747***	374	45.231***	315	28.815***
	C2		191	631		63	512		975		385	
	C3		191	431		63	379		308		589	
	C4		191	461		63	378		235		774	
	C5		191	416		63	151		415		635	
	C6		191	731		63	497		691		1,025	
A	A1	3	287	751	101.625***	95	672	80.746***	708	41.936***	884	20.937***
	A2		287	363		95	215		485		386	
	A3		287	298		95	175		262		458	
	A4		287	270		95	135		219		455	

***$p < .001$

equivalent in terms of variability. The subjects' scores during the four section trials also differed extremely in terms of variability.

Within each of the three intelligence groups, consistent results may be observed. That is, within the retarded, normal, and superior groups, the scores of the subjects in the two orientation groups did not differ in terms of variability, while those of the subjects in the six different type-frequency groups did. Further, in each intelligence group, the subjects' scores within the four sections of trials were extremely heterogeneous.

Tables 11 and 12 and Column 8 of Table 25 consist of statistics related to the mean attainment time scores of the subjects on the DLV. There were no differences among the mean attainment times of the subjects in the three intelligence groups, in the two orientation groups, in the six type-frequency groups, or in any group defined by the combination of intelligence levels and reinforcement conditions or the combination of reinforcement conditions. There was a difference among the means of the subjects' scores during the several sets of trials; however, there is no evidence that the levels or treatments groups performed differently over the same trials. The more discrete analyses suggested the following relationships. The mean of the first section of trials was larger than the means of the second section, the third section, and the fourth section. The mean of the second section was larger than that of the fourth section while the means of the second and third sections and the third and fourth sections were equivalent.

Number of Responses

Listed in Table 13 and Column 3 of Table 25 is the information relevant to the variability of the subjects' number of responses scores on the DLV. The scores of the subjects in the three intelligence groups were equivalent in terms of variability. Over the total group of subjects, those receiving the two kinds of orientation information and those receiving the six sets of type-frequency information also did not differ in variability. But, the subjects' scores in the four groups of trials were marked by extreme heterogeneity of variance. Similarly, within each intelligence group, the scores of the subjects who received the two orientation treatments and the six type-frequency treatments did not differ in terms of variability, while extremely unequal variability occurred in the scores in the several sets of trials.

The information about the means of the number of responses scores for the DLV is included in Tables 14 and 15 and Column 9 of Table 25. The subjects did show a difference over the series of trials in the number of responses required to discover the correct responses on the DLV but there is no evidence that the subjects in the several groups defined by levels, treatments, levels x treatments, or treatments x treatments showed a differential

TABLE 11

DESCRIPTION OF THE GROUPS IN TERMS OF ATTAINMENT TIME: DISCRIMINATION LEARNING VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	56	34	32	29	47	33	32	28	39	32	27	23
		C2	47	30	30	28	47	28	24	21	55	28	25	22
		C3	34	26	32	22	53	35	28	25	45	32	30	27
		C4	42	25	25	22	40	27	24	20	52	36	32	24
		C5	38	24	21	18	52	34	28	26	56	35	31	29
		C6	61	34	24	21	65	46	38	33	56	39	37	35
	D2	C1	36	26	23	21	63	37	33	28	44	22	22	21
		C2	59	35	26	24	70	64	45	39	61	35	27	24
		C3	48	33	30	26	35	23	20	19	55	36	36	32
		C4	63	34	32	24	48	36	27	25	43	34	31	30
		C5	41	29	24	20	48	31	28	27	54	28	31	34
		C6	54	40	38	34	43	25	19	17	42	24	33	30

TABLE 12

COMPARISON OF THE GROUPS IN TERMS OF ATTAINMENT TIME: DISCRIMINATION LEARNING VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	287	43,967.46		
B	2	195.57	97.79	–
D	1	38.07	38.07	–
C	5	656.83	131.37	–
BD	2	95.43	47.72	–
BC	10	1,262.35	126.24	–
DC	5	1,146.14	229.23	1.50
BDC	10	2,059.86	205.99	1.35
Error (b)	252	38,513.21	152.83	
Within Subjects	864	28,901.26		
A	3	12,551.26	4,183.75	214.88***
BA	6	101.64	16.94	–
DA	3	2.14	0.71	–
CA	15	263.79	17.59	–
BDA	6	57.64	9.61	–
BCA	30	415.97	13.87	–
DCA	15	310.00	20.67	1.06
BDCA	30	481.13	16.04	–
Error (w)	756	14,717.69	19.47	
Total	1,151	72,868.72		

B. INDIVIDUAL COMPARISONS

Comparison	$\overline{X}$	A1:49.78	A2:32.50	A3:28,75	A4:25.77		
A	Group	A1 > A2	A1 > A3	A2 > A4	A2 = A3	A2 > A4	A3 = A4
	Diff.	17.28	21.03	24.01	3.75	6.73	2.98
	t	8.772***	11.010***	12.771***	2.483	4.547***	2.129

***$p < .001$

TABLE 13

COMPARISON OF THE GROUPS IN TERMS OF NUMBER OF RESPONSES: DISCRIMINATION LEARNING VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	383	4	0.315							
	B2		383	4								
	B3		383	4								
D	D1	1	575	4	0.643	191	4	0.243	3	2.249	4	0.366
	D2		575	4		191	4		4		4	
C	C1	5	191	3	4.298	63	4	1.469	3	4.635	4	3.226
	C2		191	3		63	4		3		3	
	C3		191	4		63	4		4		4	
	C4		191	3		63	3		4		3	
	C5		191	4		63	4		4		4	
	C6		191	4		63	4		3		4	
A	A1	3	287	2	78.512***	95	2	31.480***	2	25.534***	2	23.428***
	A2		287	4		95	4		3		4	
	A3		287	4		95	4		4		4	
	A4		287	5		95	5		5		4	

***$p < .001$

TABLE 14

DESCRIPTION OF THE GROUPS IN TERMS OF NUMBER OF RESPONSES: DISCRIMINATION LEARNING VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	7	5	5	4	7	6	5	5	7	6	6	6
		C2	7	6	6	6	7	6	6	6	6	5	5	4
		C3	7	6	6	6	6	6	6	6	6	6	6	6
		C4	6	5	5	4	7	6	6	5	6	6	5	5
		C5	7	5	4	4	7	6	6	6	7	6	6	6
		C6	7	5	4	4	6	6	6	6	6	6	6	5
	D2	C1	6	5	5	5	7	6	6	5	6	5	5	5
		C2	6	5	5	5	8	7	6	6	6	6	5	5
		C3	7	6	6	6	7	7	6	6	6	5	6	5
		C4	7	6	6	4	8	7	6	6	7	7	7	7
		C5	6	5	5	5	7	6	5	5	7	6	6	6
		C6	7	6	6	6	6	5	3	3	7	5	5	4

TABLE 15

COMPARISON OF THE GROUPS IN TERMS OF NUMBER OF RESPONSES: DISCRIMINATION LEARNING VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	287	381.95		
B	2	3.93	1.97	1.50
D	1	0.25	0.25	–
C	5	7.84	1.57	1.20
BD	2	0.85	0.43	–
BC	10	12.51	1.25	–
DC	5	4.40	0.88	–
BDC	10	23.16	2.32	1.77
Error (b)	252	329.01	1.31	
Within Subjects	864	160.28		
A	3	42.14	14.05	100.36***
BA	6	2.03	0.34	2.43
DA	3	0.39	0.13	–
CA	15	1.91	0.13	–
BDA	6	0.77	0.13	–
BCA	30	2.20	0.07	–
DCA	15	0.94	0.06	–
BDCA	30	4.02	0.13	–
Error (w)	756	105.88	0.14	
Total	1,151	542.23		

B. INDIVIDUAL COMPARISONS

Comparison	$\bar{X}$	A1:6.64	A2:5.78		A3:5.53	A4:5.25	
A	Group	A1 > A2	A1 > A3	A1 > A4	A2 = A3	A2 > A4	A3 = A4
	Diff.	0.86	1.11	1.39	0.25	0.53	0.28
	$\underline{t}$	5.244***	6.894***	8.797***	1.269	2.718**	1.458

**p < .01

***p < .001

pattern of changes of performance with practice. Thus, the relationships reflected by the number of responses measure are consistent with those reflected by the attainment time measure. Further, the individual comparisons revealed that the pattern of decrements in the numbers of responses is consistent with that of the attainment times. The mean of the first section of trials was larger than those of the succeeding sections; the means of the second and third sections and the third and fourth sections were equal; and the mean of the second section was larger than that of the fourth section.

There is no evidence of differences among the mean number of responses required by the subjects in the three levels groups, in the six type-frequency groups, in the two orientation groups, or in the groups defined by the several levels x treatments or treatments x treatments combinations. These latter results also are consistent with those related to the attainment time measures.

Level of Aspiration Responses

Absolute Goal Discrepancy Scores

Table 16 consists of the data related to the inter-individual variability of the subjects' absolute goal discrepancy scores on the DLV and in Column 4 of Table 25 is listed a summary of the pertinent relationships. Over the total group of subjects, extreme heterogeneity of variance was present in the subjects' scores when they were categorized according to levels, orientation, type-frequency, and trials. With one exception, this extreme heterogeneity was apparent within each of the three intelligence groups. The one exception was related to the orientation condition. In both the retarded and normal groups, the subjects who received the two orientation treatments were equivalent in terms of score variability; on the other hand, in the superior group the corresponding subjects differed in terms of score variability.

Information about the subjects' mean absolute goal discrepancy scores for DLV performance appears in Tables 17 and 18 and Column 10 of Table 25. In no case were there differences among the mean absolute goal discrepancy scores of the subjects when these scores were categorized according to levels, type-frequency, orientation, trials, or any combination of these.

Positive Goal Discrepancy Scores

The statistics reflecting the variability of the subjects' positive goal discrepancy scores related to the DLV are included in Table 19 and Column 5 of Table 25. There is consistency in the results of the comparisons within the several classifications: extreme heterogeneity of variance existed

TABLE 16

COMPARISON OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	319	42	837.525***							
	B2		319	58								
	B3		319	800								
D	D1	1	479	73	408.866***	159	39	0.778	53	0.917	125	197.046***
	D2		479	528		159	45		62		1,475	
C	C1	4	191	26	1,276.187***	63	56	81.206***	14	63.675***	5	806.728***
	C2		191	31		63	13		61		18	
	C3		191	25		63	16		44		15	
	C4		191	1,292		63	33		53		3,720	
	C5		191	113		63	91		114		138	
A	A1	3	239	93	703.091***	79	87	73.716***	145	110.969***	45	412.475***
	A2		239	20		79	16		18		26	
	A3		239	287		79	47		32		773	
	A4		239	805		79	19		28		2,363	

*** $p < .001$

TABLE 17

DESCRIPTION OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	2	6	11	5	3	3	4	5	4	3	3	3
		C2	6	4	5	4	10	5	4	3	9	3	5	4
		C3	2	4	3	2	4	4	7	7	6	5	7	5
		C4	4	4	6	6	10	6	5	4	8	8	21	8
		C5	5	4	4	5	8	9	5	4	6	5	4	2
	D2	C1	4	4	5	4	9	3	3	4	3	2	2	3
		C2	6	4	4	5	10	4	4	5	6	4	5	5
		C3	7	3	4	3	3	3	4	2	4	3	3	3
		C4	6	3	5	4	7	6	9	2	7	5	32	58
		C5	15	8	7	3	14	5	3	5	4	8	14	10

TABLE 18

COMPARISON OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	15,552.37		
B	2	155.90	77.95	1.20
D	1	45.31	45.31	-
C	4	543.11	135.78	2.10
BD	2	68.94	34.47	-
BC	8	750.05	93.76	1.45
DC	4	124.60	31.15	-
BDC	8	272.29	34.04	-
Error (b)	210	13,592.17	64.72	
Within Subjects	720	20,475.63		
A	3	71.26	23.75	-
BA	6	252.50	42.08	1.47
DA	3	53.38	17.79	-
CA	12	357.54	29.80	1.04
BDA	6	252.77	42.13	1.47
BCA	24	675.17	28.13	-
DCA	12	250.48	20.87	-
BDCA	24	517.24	21.55	-
Error (w)	630	18,045.29	28.64	
Total	959	36,028.00		

TABLE 19

COMPARISON OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
						B1			B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	319	35	38.509***							
	B2		319	52								
	B3		319	71								
D	D1	1	479	63	21.016***	159	49	26.093***	23	57.681***	118	96.587***
	D2		479	42		159	21		81		23	
C	C1	4	191	30	324.859***	63	73	50.241***	14	207.332***	6	289.284***
	C2		191	24		63	17		37		19	
	C3		191	10		63	18		4		7	
	C4		191	102		63	44		42		216	
	C5		191	92		63	24		161		92	
A	A1	3	239	59	59.606***	79	33	57.327***	122	135.304***	23	77.839***
	A2		239	29		79	11		26		52	
	A3		239	78		79	66		8		158	
	A4		239	43		79	30		52		49	

***$p < .001$

in the subjects' positive goal discrepancy scores in every case.

Tables 20 and 21 and Column 11 of Table 25 contain figures pertinent to the mean positive goal discrepancy scores for the DLV. The probability of the F ratio associated with the comparison of the type-frequency groups is less than .01 but greater than .001. However, since the probability of the corresponding chi square is less than .001 and it must be inferred that extreme heterogeneity of variance occurred, the criterion for rejecting the null hypothesis related to the means becomes the .001 level. Consequently, the F ratio yielded by the analysis of the differences among the means cannot be considered significant. Further, in no other comparison were there differences among the mean positive goal discrepancy scores evident.

Negative Goal Discrepancy Scores

Listed in Table 22 and Column 6 of Table 25 is the information about the variability of the subjects' negative goal discrepancy scores pertinent to the DLV. Within the total group of subjects, extreme heterogeneity of variance occurred among the scores in the three intelligence groups, the two orientation groups, the six type-frequency groups, and the four sections of trials. Excepting the comparisons of the orientation groups, the results of the analyses of the scores within each of the three intelligence groups are consistent with this. While extreme heterogeneity of variance occurred in the orientation groups comparison within both the normal and superior groups, there was equivalent score variability in the two corresponding retarded groups.

The data pertinent to the mean negative goal discrepancy scores on the DLV (Tables 23 and 24, and Column 12 of Table 25) indicate the following: in no case is there reason to believe that differences occurred among the mean negative goal discrepancy scores associated with the levels, the treatments, or the trials categories, or any combination of these.

Direction of Goal Changes After Success or Failure

The data included in Table 26 reflect the number of times that the subjects in the several groups did not change, raised, or lowered their goals after they received success or failure information related to their performance on the DLV. No significant differences occurred among the proportions of the groups compared. The subjects receiving different reinforcement information on the DLV generally responded in a similar manner: to wit, after success they tended to raise their goals and after failure they tended to lower them.

TABLE 20

DESCRIPTION OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING VERBAL TASK (MEANS, ROUNDED)

Level			B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	2	2	11	2	2	2	3	3	2	2	2	2
		C2	2	3	6	3	3	6	2	2	4	3	5	2
		C3	1	4	3	2	1	3	3	1	2	2	2	2
		C4	4	4	2	6	7	2	3	3	8	6	20	10
		C5	2	3	4	3	2	5	3	2	1	11	4	1
	D2	C1	1	1	4	1	6	2	1	1	3	1	1	2
		C2	3	4	3	3	8	4	4	4	5	5	4	2
		C3	6	3	4	1	1	3	2	0	2	3	4	3
		C4	5	3	3	3	4	7	5	1	5	4	4	1
		C5	5	4	4	1	11	4	2	9	2	1	6	5

TABLE 21

COMPARISON OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING NON-VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	1,937.12		
B	2	5.91	2.96	-
D	1	1.75	1.75	-
C	4	120.45	30.11	4.03**
BD	2	27.04	13.52	1.81
BC	8	78.41	9.80	1.31
DC	4	52.53	13.13	1.76
BDC	8	82.81	10.35	1.39
Error (b)	210	1,568.22	7.47	
Within Subjects	720	4,346.88		
A	3	31.69	10.56	1.72
BA	6	37.41	6.24	1.02
DA	3	42.62	14.21	2.31
CA	12	24.17	2.01	-
BDA	6	3.69	0.62	-
BCA	24	130.88	5.45	-
DCA	12	61.09	5.09	-
BDCA	24	144.74	6.03	-
Error (w)	630	3,870.59	6.14	
Total	959	6,284.00		

***$p < .01$

TABLE 22

COMPARISON OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	319	47	995.987^{***}							
	B2		319	37								
	B3		319	877								
D	D1	1	479	85	371.113^{***}	159	49	1.75	54	44.727^{***}	151	182.847^{***}
	D2		479	555		159	40		18		1,603	
C	C1	4	191	22	$1,458.428^{***}$	63	50	111.100^{***}	10	50.883^{***}	5	837.976^{***}
	C2		191	24		63	16		42		15	
	C3		191	25		63	7		49		21	
	C4		191	1,440		63	59		57		4,150	
	C5		191	79		63	90		27		121	
A	A1	3	239	54	685.820^{***}	79	71	34.272^{***}	54	11.513^{**}	38	406.124^{***}
	A2		239	35		79	39		32		35	
	A3		239	388		79	49		35		1,074	
	A4		239	803		79	18		26		2,365	

$^{**}p < .01$

$^{***}p < .001$

TABLE 23

DESCRIPTION OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	0	6	8	3	1	3	2	3	2	3	3	2
		C2	4	3	4	2	8	4	4	3	4	2	2	2
		C3	1	3	2	1	3	4	5	8	4	4	7	4
		C4	1	6	8	2	4	9	4	2	0	6	20	3
		C5	3	2	2	5	6	7	3	3	5	2	2	1
	D2	C1	3	5	4	3	3	2	2	3	0	2	2	2
		C2	3	4	4	4	2	4	3	3	1	3	4	4
		C3	1	3	5	4	1	3	3	3	2	1	2	1
		C4	1	1	2	2	2	4	6	2	2	3	34	57
		C5	10	6	5	3	3	4	2	2	2	10	9	7

TABLE 24

COMPARISON OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	17,823.06		
B	2	122.10	61.05	-
D	1	21.92	21.92	-
C	4	365.42	91.36	1.21
BD	2	114.17	57.09	-
BC	8	712.36	89.05	1.18
DC	4	120.73	30.18	-
BDC	8	453.57	56.70	-
Error (b)	210	15,912.79	75.78	
Within Subjects	720	20,510.57		
A	3	120.83	40.28	1.42
BA	6	212.95	35.49	1.25
DA	3	86.60	28.87	1.02
CA	12	420.02	35.00	1.23
BDA	6	185.15	30.86	1.09
BCA	24	755.74	31.49	1.11
DCA	12	357.24	29.77	1.05
BDCA	24	511.64	21.32	-
Error (w)	630	17,860.40	28.35	
Total	959	38,333.63		

TABLE 25

SUMMARY OF THE RESULTS OF THE COMPARISONS OF THE GROUPS IN TERMS OF THE RESPONSE MEASURES RELATED TO THE DISCRIMINATION LEARNING VERBAL TASK

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	χ^2						F				
Response Measure	Att.	No. R	G. D. Ab.	G. D+	G. D-	Comparison	Att.	No. R	G. D. Ab.	G. D+	G. D-
Table	10	13	16	19	22		12	15	18	21	24
Comparison B	.001	N.S.	.001	.001	.001	B	N.S.	N.S.	N.S.	N.S.	N.S.
D	N.S.	N.S.	.001	.001	.001	D	N.S.	N.S.	N.S.	N.S.	N.S.
C	.001	N.S.	.001	.001	.001	C	N.S.	N.S.	N.S.	.01[c]	N.S.
A	.001	.001	.001	.001	.001	A	.001[a]	.001[b]	N.S.	N.S.	N.S.
B1 D	N.S.	N.S.	N.S.	.001	N.S.	BD	N.S.	N.S.	N.S.	N.S.	N.S.
B1 C	.001	N.S.	.001	.001	.001	BC	N.S.	N.S.	N.S.	N.S.	N.S.
B1 A	.001	.001	.001	.001	.001	DC	N.S.	N.S.	N.S.	N.S.	N.S.
						BDC	N.S.	N.S.	N.S.	N.S.	N.S.
B2 D	N.S.	N.S.	N.S.	.001	.001	BA	N.S.	N.S.	N.S.	N.S.	N.S.
B2 C	.001	N.S.	.001	.001	.001	DA	N.S.	N.S.	N.S.	N.S.	N.S.
B2 A	.001	.001	.001	.001	.01	CA	N.S.	N.S.	N.S.	N.S.	N.S.
						BDA	N.S.	N.S.	N.S.	N.S.	N.S.
B3 D	N.S.	N.S.	.001	.001	.001	BCA	N.S.	N.S.	N.S.	N.S.	N.S.
B3 C	.001	N.S.	.001	.001	.001	DCA	N.S.	N.S.	N.S.	N.S.	N.S.
B3 A	.001	.001	.001	.001	.001	BDCA	N.S.	N.S.	N.S.	N.S.	N.S.

[a] $A1 > A2; A1 > A3; A1 > A4; A2 = A3; A2 > A4; A3 = A4$

[b] $A1 > A2; A1 > A3; A1 > A4; A2 = A3; A2 > A4; A3 = A4$

[c] N.B.: Corresponding χ^2 occurs at $p < .001$

TABLE 26

COMPARISON OF THE GROUPS IN TERMS OF DIRECTIONS OF GOAL CHANGE AFTER SUCCESS AND FAILURE: DISCRIMINATION LEARNING VERBAL TASK (FREQUENCIES)

Comparison	Trial 9				Trial 10				Trial 17				Trial 18			
	Direction				Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	5	2	1	8	8	0	0	8	6	2	0	8	7	1	0	8
B1D1C2	6	1	1	8	6	1	1	8	6	1	1	8	5	1	2	8
B1D1C5	5	0	0	5	2	1	0	3	2	1	1	4	3	0	0	3
B1D2C1	6	1	1	8	8	0	0	8	6	0	2	8	7	0	1	8
B1D2C2	5	2	1	8	6	2	0	8	5	2	1	8	7	0	1	8
B1D2C5	4	0	1	5	5	1	0	6	5	1	0	6	4	0	0	4
B2D1C1	6	2	0	8	8	0	0	8	6	1	1	8	7	0	1	8
B2D1C2	8	0	0	8	7	1	0	8	7	0	1	8	7	0	1	8
B2D1C5	4	1	0	5	5	0	0	5	3	1	1	5	4	0	0	4
B2D2C1	7	0	1	8	7	1	0	8	7	1	0	8	7	1	0	8
B2D2C2	6	1	1	8	5	1	2	8	5	1	2	8	8	0	0	8
B2D2C5	6	0	0	6	4	0	0	4	2	3	1	6	3	1	3	7
B3D1C1	6	0	2	8	7	0	1	8	6	1	1	8	7	0	1	8
B3D1C2	8	0	0	8	8	0	0	8	7	0	1	8	8	0	0	8
B3D1C5	5	0	1	6	4	1	1	6	1	1	3	5	3	0	1	4
B3D2C1	7	0	1	8	8	0	0	8	7	0	1	8	7	0	1	8
B3D2C2	4	0	4	8	7	0	1	8	6	0	2	8	6	0	2	8
B3D2C5	4	2	1	7	5	0	1	6	5	1	0	6	2	2	1	5

	Trial 9				Trial 10				Trial 17				Trial 18			
	Direction				Direction				Direction				Direction			
	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T
B1D1C3	0	7	1	8	0	7	1	8	0	7	1	8	0	7	1	8
B1D1C4	0	6	2	8	0	6	2	8	0	5	3	8	0	7	1	8
B1D1C5	1	1	1	3	0	4	1	5	0	3	1	4	0	3	2	5
B1D2C3	1	6	1	8	0	7	1	8	2	6	0	8	2	6	0	8
B1D2C4	2	4	2	8	0	8	0	8	0	5	3	8	0	7	1	8
B1D2C5	0	2	1	3	0	1	1	2	0	0	2	2	0	3	1	4
B2D1C3	0	6	2	8	0	7	1	8	2	4	2	8	1	6	1	8
B2D1C4	0	6	2	8	1	6	1	8	2	5	1	8	0	7	1	8
B2D1C5	0	2	1	3	0	2	1	3	0	2	1	3	0	3	1	4
B2D2C3	0	8	0	8	0	6	2	8	1	6	1	8	0	6	2	8
B2D2C4	1	5	2	8	0	7	1	8	0	6	2	8	1	5	2	8
B2D2C5	1	0	1	2	1	3	0	4	0	2	0	2	0	1	0	1
B3D1C3	0	7	1	8	1	7	0	8	1	7	0	8	0	8	0	8
B3D1C4	3	4	1	8	0	7	1	8	0	6	2	8	1	4	3	8
B3D1C5	1	1	0	2	1	1	0	2	0	1	2	3	2	2	0	4
B3D2C3	0	7	1	8	1	5	2	8	1	7	0	8	2	6	0	8
B3D2C4	0	5	3	8	1	4	3	8	0	6	2	8	0	6	2	8
B3D2C5	0	1	0	1	0	2	0	2	1	1	0	2	0	3	0	3

TABLE 26--Continued

Comparison	Trial 11				Trial 14				Trial 15				Trial 19			
	Direction				Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	7	1	0	8	6	1	1	8	8	0	0	8	7	0	1	8
B1D1C2	6	1	1	8	4	2	2	8	7	0	1	8	6	1	1	8
B1D1C3	8	0	0	8	6	2	0	8	7	1	0	8	7	0	1	8
B1D1C5	4	0	1	5	3	1	1	5	2	0	2	4	2	0	1	3
B1D2C1	7	1	0	8	6	1	1	8	7	0	1	8	6	1	1	8
B1D2C2	8	0	0	8	7	1	0	8	6	0	2	8	5	2	1	8
B1D2C3	5	0	3	8	7	0	1	8	7	1	0	8	7	0	1	8
B1D2C5	3	1	1	5	1	2	0	3	2	2	0	4	3	1	1	5
B2D1C1	7	0	1	8	7	1	0	8	8	0	0	8	7	0	1	8
B2D1C2	7	0	1	8	7	0	1	8	7	0	1	8	6	1	1	8
B2D1C3	6	1	1	8	6	1	1	8	7	1	0	8	7	1	0	8
B2D1C5	6	0	0	6	5	0	0	5	3	1	0	4	4	0	0	4
B2D2C1	6	2	0	8	8	0	0	8	7	0	1	8	8	0	0	8
B2D2C2	8	0	0	8	7	0	1	8	7	1	0	8	7	1	0	8
B2D2C3	7	0	1	8	7	1	0	8	6	2	0	8	6	2	0	8
B2D2C5	5	0	1	6	3	0	1	4	4	0	2	6	6	0	1	7
B3D1C1	5	2	1	8	7	1	0	8	7	0	1	8	8	0	0	8
B3D1C2	7	1	0	8	6	2	1	8	6	1	1	8	8	0	0	8
B3D1C3	5	0	3	8	5	0	3	8	4	3	1	8	5	2	1	8
B3D1C5	2	0	1	3	6	0	0	6	3	1	2	6	3	0	0	3
B3D2C1	8	0	0	8	7	1	0	8	8	0	0	8	8	0	0	8
B3D2C2	6	1	1	8	7	0	1	8	8	0	0	8	5	0	3	8
B3D2C3	8	0	0	8	8	0	0	8	8	0	0	8	8	0	0	8
B3D2C5	4	4	0	8	2	1	2	5	4	2	2	8	4	0	2	6

	Trial 12				Trial 13				Trial 16				Trial 20			
	Direction				Direction				Direction				Direction			
	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T
B1D1C2	2	4	2	8	1	6	1	8	1	6	1	8	1	6	1	8
B1D1C3	0	7	1	8	1	6	1	8	0	7	1	8	0	7	1	8
B1D1C4	0	6	2	8	3	3	2	8	0	7	1	8	0	6	2	8
B1D1C5	0	3	1	4	1	1	2	4	0	2	1	3	1	1	1	3
B1D2C2	0	6	2	8	3	3	2	8	1	4	3	8	0	4	4	8
B1D2C3	1	6	1	8	2	5	1	8	1	7	0	8	2	5	1	8
B1D2C4	0	7	1	8	0	6	2	8	2	5	1	8	2	6	0	8
B1D2C5	2	2	0	4	1	1	1	3	0	2	1	3	2	1	0	3
B2D1C2	1	6	1	8	2	5	1	8	3	5	0	8	0	8	0	8
B2D1C3	0	4	4	8	0	7	1	8	0	4	4	8	0	6	2	8
B2D1C4	0	6	2	8	0	8	0	8	0	7	1	8	1	6	1	8
B2D1C5	0	2	1	3	1	2	1	4	0	2	1	3	1	3	1	5
B2D2C2	1	7	0	8	0	5	3	8	2	5	1	8	0	7	1	8
B2D2C3	0	7	1	8	0	7	1	8	2	6	0	8	0	7	1	8
B2D2C4	0	7	1	8	1	6	1	8	1	6	1	8	0	5	3	8
B2D2C5	1	2	0	3	1	2	0	3	1	2	1	4	0	3	1	4
B3D1C2	1	7	0	8	3	4	1	8	2	5	1	8	2	5	1	8
B3D1C3	0	8	0	8	2	6	0	8	0	8	0	8	1	6	1	8
B3D1C4	2	4	2	8	1	5	2	8	1	4	3	8	2	6	0	8
B3D1C5	0	2	0	2	0	2	1	3	0	5	3	8	0	2	2	4
B3D2C2	2	6	0	8	0	7	1	8	2	5	1	8	1	4	3	8
B3D2C3	0	7	1	8	0	8	0	8	0	7	1	8	1	7	0	8
B3D2C4	1	7	0	8	2	5	1	8	2	3	3	8	1	5	2	8
B3D2C5	0	3	0	3	0	1	0	1	0	4	0	4	1	4	0	5

TABLE 26--Continued

Comparison	Trial 21				Trial 22				Trial 23			
	Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	7	1	0	8	8	0	0	8	5	3	0	8
B1D1C2	5	1	2	8	6	1	1	8	6	1	1	8
B1D1C3	8	0	0	8	8	0	0	8	7	0	1	8
B1D1C4	5	2	1	8	6	0	2	8	6	0	2	8
B1D1C5	4	0	2	6	0	1	1	2	1	0	2	3
B1D2C1	5	2	1	8	5	2	1	8	6	1	1	8
B1D2C2	6	1	1	8	5	2	1	8	7	1	0	8
B1D2C3	6	0	2	8	5	2	1	8	5	1	2	8
B1D2C4	7	0	1	8	7	1	0	8	8	0	0	8
B1D2C5	2	1	0	3	6	0	1	7	2	3	0	5
B2D1C1	6	1	1	8	5	1	2	8	6	1	1	8
B2D1C2	6	1	1	8	5	0	3	8	7	0	1	8
B2D1C3	7	1	0	8	7	1	0	8	6	2	0	8
B2D1C4	5	0	3	8	7	0	1	8	7	0	1	8
B2D1C5	2	0	2	4	4	1	1	6	3	0	0	3
B2D2C1	6	1	1	8	6	2	0	8	7	1	0	8
B2D2C2	6	2	0	8	8	0	0	8	7	1	0	8
B2D2C3	6	1	1	8	6	0	2	8	8	0	0	8
B2D2C4	5	0	3	8	7	0	1	8	7	0	1	8
B2D2C5	3	2	0	5	1	0	3	4	5	0	1	6
B3D1C1	7	0	1	8	8	0	0	8	8	0	0	8
B3D1C2	8	0	0	8	8	0	0	8	6	2	0	8
B3D1C3	5	1	2	8	6	1	1	8	4	2	2	8
B3D1C4	6	0	2	8	7	0	1	8	7	0	1	8
B3D1C5	2	0	1	3	4	0	2	6	2	0	3	5
B3D2C1	7	1	0	8	8	0	0	8	8	0	0	8
B3D2C2	7	0	1	8	6	2	0	8	6	1	1	8
B3D2C3	8	0	0	8	8	0	0	8	8	0	0	8
B3D2C4	4	2	2	8	6	1	1	8	4	2	2	8
B3D2C5	4	3	0	7	3	1	2	6	2	1	2	5

Discrimination Learning Non-Verbal Task

Information about the subjects' learning performance and level of aspiration responses on the DLN is contained in Tables 27 through 40. The types of data which these tables include are the following: Tables 27, 28, and 29, attainment time scores; Tables 30, 31, and 32, absolute goal discrepancy scores; Tables 33, 34, and 35, positive goal discrepancy scores; and Tables 36, 37, and 38, negative goal discrepancy scores. The summary of the results of the several statistical analyses is presented in Table 39. The material pertinent to direction of goal changes appears in Table 40.

Learning Performance

Attainment Time

Table 27 and Column 2 of Table 39 include data pertinent to the within groups variability of the subjects' attainment time scores as they responded to the DLN. Extreme heterogeneity of variance was present in the attainment times when the total group of subjects was categorized according to levels, orientation of reinforcement, and type-frequency of reinforcement, and when the subjects' scores were classified according to trials. When the scores of the levels groups were scrutinized separately, the same pattern of relationships was apparent within the normal group but not within the retarded and superior groups. Within both of these latter groups, there was homogeneity of variance when the subjects were categorized according to orientation and type-frequency of information and heterogeneity of variance when the scores in the several groups of trials were compared.

The statistics reflecting mean attainment time performance of the subjects on the DLN are listed in Tables 28 and 29 and Column 7 of Table 39. These statistics suggest that there was a difference among the means of the scores in the three intelligence groups, the four sections trials, and the cells defined by the overlap of levels and trials. Subsequent analyses revealed that the differences among trial means were localized between every section of trials with the means of the latter sections being smaller than those of the preceding sections. The intelligence groups differed in terms of mean performance. The retarded group had a lower mean than did the normal and the superior groups; and the normal group had a lower mean than did the superior group. Differences occurred among the means of the cells formed by the overlap of the levels and trials factors. Further scrutiny indicated that the following pattern of relationships occurred. In each of the four sections of trials, the mean of the retarded group was lower than those of the normal and superior groups while the means of these latter groups were equivalent. In all

TABLE 27

COMPARISON OF THE GROUPS IN TERMS OF ATTAINMENT TIME: DISCRIMINATION LEARNING NON-VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
						B1			B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	383	605	47.942***							
	B2		383	1,091								
	B3		383	1,190								
D	D1	1	575	1,249	18.536***	191	558	0.966	1,498	35.581***	1,272	0.863
	D2		575	871		191	644		631		1,113	
C	C1	5	191	811	32.834***	63	610	13.632	406	79.860***	1,234	4.615
	C2		191	949		63	744		852		975	
	C3		191	1,085		63	770		653		1,507	
	C4		191	914		63	332		869		1,241	
	C5		191	924		63	616		751		958	
	C6		191	1,649		63	509		2,916		1,254	
A	A1	3	287	1,878	324.468***	95	946	61.342***	2,163	148.904***	1,804	107.928***
	A2		287	595		95	406		505		560	
	A3		287	359		95	265		308		353	
	A4		287	303		95	237		266		284	

***$p < .001$

TABLE 28

DESCRIPTION OF THE GROUPS IN TERMS OF ATTAINMENT TIME: DISCRIMINATION LEARNING NON-VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	92	74	59	52	98	83	72	66	115	82	70	64
		C2	75	58	50	48	94	86	73	66	103	94	81	78
		C3	70	61	50	44	119	85	66	66	136	98	72	68
		C4	74	62	53	48	117	77	62	58	114	79	67	58
		C5	74	60	52	48	106	92	78	72	133	90	72	62
		C6	87	72	60	52	146	107	86	75	129	95	77	70
	D2	C1	88	67	63	59	92	74	66	60	134	96	80	71
		C2	96	72	66	61	102	77	62	57	123	96	76	70
		C3	103	68	56	52	93	75	66	60	118	88	71	63
		C4	71	57	47	43	92	72	59	51	126	82	66	62
		C5	81	65	58	52	119	82	63	61	117	97	79	72
		C6	79	65	58	57	100	81	67	59	105	80	66	59

TABLE 29

COMPARISON OF THE GROUPS IN TERMS OF ATTAINMENT TIME: DISCRIMINATION LEARNING NON-VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	287	79,155.84		
B	2	14,361.19	7,180.60	31.20***
D	1	168.92	168.92	-
C	5	1,355.09	271.02	1.18
BD	2	1,496.78	748.39	3.21
BC	10	1,348.92	134.89	-
DC	5	1,417.88	283.58	1.23
BDC	10	1,009.66	100.97	-
Error (b)	252	57,997.40	230.15	
Within Subjects	864	73,358.44		
A	3	40,008.21	13,336.07	357.15***
BA	6	1,987.57	331.26	8.87***
DA	3	19.16	6.39	-
CA	15	402.84	26.86	-
BDA	6	89.59	14.93	-
BCA	30	722.21	24.07	-
DCA	15	631.85	42.12	-
BDCA	30	1,268.75	42.29	-
Error (w)	756	28,228.26	37.34	
Total	1,151	152,514.28		

TABLE 29—Continued

B. INDIVIDUAL COMPARISONS

Comparison							
	$\overline{X}$	B1:63.73	B2:80.00	B3:87.58			
	Group	B1 < B2	B1 < B3	B2 < B3			
B	Diff.	16.27	28.85	7.58			
	t	7.748***	11.042***	3.107**			
	$\overline{X}$	A1:103.36	A2:79.14	A3:65.81	A4:60.11		
	Group	A1 > A2	A1 > A3	A1 > A4	A2 > A3	A2 > A4	A3 > A4
A	Diff.	24.22	37.55	43.25	13.33	19.03	5.70
	t	8.266***	13.459***	15.727***	7.324***	10.751***	3.750***
	$\overline{X}$	B1A1:82.50	B2A1:106.50	B3A1:121.08	B1A2:65.08		
	Group	B1A1 < B2A1	B1A1 < B3A1	B2A1 = B3A1	B1A2 < B2A2		
	Diff.	24.00	38.58	14.58	17.50		
	t	4.218***	7.211***	2.271	5.681***		
	$\overline{X}$	B2A2:82.58	B3A2:89.75	B1A3:56.00	B2A3:68.33		
	Group	B1A2 < B3A2	B2A2 = B3A2	B1A3 < B2A3	B1A3 < B3A3		
BA	Diff.	24.67	7.17	12.33	17.08		
	t	7.782***	2.153	5.053***	6.751***		
	$\overline{X}$	B3A3:73.08	B1A4:51.33	B2A4:62.58	B3A4:66.42		
	Group	B2A3 = B3A3	B1A4 < B2A4	B1A4 < B3A4	B2A4 = B3A4		
	Diff.	4.75	11.25	15.09	3.84		
	t	1.813	4.934***	6.476***	1.607		

$^{**}p < .01$

$^{***}p < .001$

four comparisons, while the means of the normal group were lower than those of the superior group, the sizes of the associated *t*-ratios were not large enough to reach the criterion for significance; in the first two sections of trials, the differences and the *t*-ratios were larger than they were in the last two sections.

Differences did not occur among the mean attainment times of the subjects in the orientation groups, in the type-frequency groups, or, with the one exception noted above, in subgroups formed by any combination of the levels, treatments, and/or trials.

Level of Aspiration Responses

Absolute Goal Discrepancy Scores

The data reflecting the relationships among the variability of the subjects' absolute goal discrepancy scores as they responded to the DLN are contained in Table 30 and Column 3 of Table 39. Over the total group of subjects, homogeneity existed among the scores of the subjects in the two orientation groups, while heterogeneity occurred when the scores were categorized according to levels, type-frequency, and trials. The same pattern was present within the normal group but not within the retarded and superior groups. In these two, there was heterogeneity in the scores related to the type-frequency, trials, and orientation classifications.

Examination of Tables 31 and 32 and Column 8 of Table 39 will reveal evidence about the subjects' mean absolute discrepancy scores for DLN performance. Differences among the mean absolute goal discrepancy scores in the several sets of trials occurred. Subsequent analyses revealed that these relationships were apparent: the mean of the first section was larger than those of each of the three succeeding sections; the means of the second and third sections, the second and fourth sections, and the third and fourth sections were equivalent.

The F-ratio yielded by the analysis of the differences among the mean scores of the several type-frequency groups is associated with a probability of less than .01 but greater than .001. However, the probability of concomitant chi square indicates that extreme heterogeneity of variance was present in the contributing scores. Therefore, the criterion for rejection of the null hythothsis is not satisfied and this F-ratio cannot be regarded as significant. No differences existed among the mean scores of the subjects when they were grouped according to levels, orientations, or any combination of levels; treatments, and/or trials.

TABLE 30

COMPARISON OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING NON-VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	319	36	210.712***							
	B2		319	171								
	B3		319	58								
D	D1	1	479	85	1.085	159	194	35.508***	143	4.569	89	51.676***
	D2		479	93		159	510		201		27	
C	C1	4	191	18	337.732***	63	22	57.704***	16	254.007***	15	82.370***
	C2		191	76		63	49		40		140	
	C3		191	69		63	69		78		60	
	C4		191	39		63	11		69		39	
	C5		191	234		63	28		628		34	
A	A1	3	239	273	674.719***	79	69	56.921***	556	288.977***	180	256.231***
	A2		239	25		79	36		30		10	
	A3		239	17		79	12		26		12	
	A4		239	27		79	27		41		15	

***$p < .001$

TABLE 31

DESCRIPTION OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING NON-VERBAL TASK (MEANS, ROUNDED)

	Level		B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	6	2	6	4	6	4	3	4	4	4	3	3
		C2	2	2	3	3	8	2	2	3	18	4	3	3
		C3	4	4	2	2	7	4	5	5	15	5	5	4
		C4	2	4	4	4	11	4	7	2	10	3	4	2
		C5	8	6	6	7	24	7	10	14	9	10	6	6
	D2	C1	5	4	4	4	6	4	4	4	8	5	4	4
		C2	14	4	3	3	9	5	2	4	6	3	5	2
		C3	8	11	5	9	16	10	4	4	10	4	5	4
		C4	5	6	6	5	5	4	6	4	5	3	6	4
		C5	5	5	6	5	29	5	2	3	6	6	7	8

TABLE 32

COMPARISON OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING NON-VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	4,056.54		
B	2	51.85	25.93	1.58
D	1	3.59	3.59	-
C	4	253.99	63.50	3.87**
BD	2	38.19	19.10	1.16
BC	8	117.20	14.65	–
DC	4	62.23	15.56	–
BDC	8	84.36	10.55	–
Error (b)	210	3,445.13	16.41	
Within Subjects	720	6,600.69		
A	3	437.44	145.81	17.48***
BA	6	144.19	24.03	2.88
DA	3	4.23	1.41	–
CA	12	124.15	10.35	1.24
BDA	6	81.90	13.65	1.64
BCA	24	328.13	13.67	1.64
DCA	12	38.39	3.20	–
BDCA	24	175.72	7.32	–
Error (w)	630	5,256.54	8.34	
Total	959	10,657.23		

B. INDIVIDUAL COMPARISONS

Comparison	$\overline{X}$	A1:9.04	A2:4.81	A3:4.67	A4:4.45		
A	Group	A1>A2	A1>A3	A1>A4	A2=A3	A2=A4	A3=A4
	Diff.	4.23	4.37	4.59	0.14	0.36	0.22
	t	3.811***	3.991***	4.139***	0.335	0.774	0.511

$^{**}p < .01$

$^{***}p < .001$

Positive Goal Discrepancy Scores

The statistics reflecting the variability of the subjects' positive goal discrepancy scores as they performed on the DLN appear in Table 33 and Column 4 of Table 39. Over the total group of subjects, there were extreme differences in variability when the scores were categorized according to levels, orientation, type-frequency, and trials. This was also the case when the scores of the subjects within the retarded group were analyzed separately. In the normal and superior groups, the scores of the subjects who received the two sets of orientation information did not differ in terms of variability whereas an extreme difference existed when the scores were analyzed according to type-frequency and trials.

The relationships among the means of the positive goal discrepancy scores related to DLN performance are reflected in the evidence in Tables 34 and 35 and Column 9 of Table 39. Differences existed among the means of the several sections of trials. The pattern of these differences was this: equivalence was present between the means of the first and the second sections, the first and the third sections, and the second and the third sections; the mean of the fourth section was smaller than those of the first, second, and third sections, respectively. There were no differences among the means when the scores were grouped according to levels, treatments, or the several combinations of levels, treatments, and/or trials.

Negative Goal Discrepancy Scores

Table 36 and Column 5 of Table 39 are composed of information about the variances of the subjects' negative goal discrepancy scores related to the DLN. Over the total group of subjects, extreme heterogeneity of variance was present in the negative goal discrepancy scores of the subjects when they were classified according to levels, treatments, and trials. Consistent relationships occurred within the retarded and superior groups and, with one exception, within the normal group. This exception was in the scores of the normal subjects in the two orientation groups; homogeneity of variance existed here.

The evidence pertinent to the central tendencies of the subjects' negative goal discrepancy scores on the DLN is in Tables 37 and 38 and Column 10 of Table 39. With one exception, there were no indications of differences among the means of the subjects' scores in the three levels groups, the several treatments groups, the four sections of trials, or in the groups defined by the overlap of the levels, treatments, and/or trials factors. The one exception: a probability level which is less than .01 but greater than .001 is associated with the F ratio yielded by the comparison of the means of the groups defined by

TABLE 33

COMPARISON OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING NON-VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	319	48	324.259***							
	B2		319	197								
	B3		319	29								
D	D1	1	479	70	27.622***	159	15	102.745***	164	4.632	28	0.120
	D2		479	114		159	80		232		30	
C	C1	4	191	17	348.813***	63	12	116.866***	20	204.704***	18	40.049***
	C2		191	44		63	54		51		28	
	C3		191	102		63	132		112		63	
	C4		191	57		63	18		132		19	
	C5		191	236		63	25		636		19	
A	A1	3	239	240	327.594***	79	58	129.258***	573	169.701***	77	142.324***
	A2		239	58		79	108		55		12	
	A3		239	40		79	14		87		18	
	A4		239	26		79	12		59		6	

***$p < .001$

TABLE 34

DESCRIPTION OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING NON-VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	2	2	6	4	3	2	2	1	2	3	2	2
		C2	2	2	4	1	5	1	2	1	2	3	2	1
		C3	3	3	2	2	6	2	6	7	9	4	3	2
		C4	2	4	2	4	10	5	10	1	5	3	3	2
		C5	8	4	5	3	24	7	8	13	5	4	2	2
	D2	C1	4	4	4	3	3	3	5	2	7	2	2	2
		C2	13	4	3	3	8	7	2	3	6	3	6	1
		C3	2	15	4	3	10	13	6	2	7	5	5	2
		C4	5	7	7	5	2	4	10	4	2	4	6	3
		C5	3	5	5	5	29	6	2	4	6	5	4	3

TABLE 35

COMPARISON OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING NON-VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	4,198.12		
B	2	124.55	62.28	3.69
D	1	35.04	35.04	2.08
C	4	196.36	49.09	2.91
BD	2	14.44	7.22	-
BC	8	206.58	25.82	1.53
DC	4	38.41	9.60	-
BDC	8	38.45	4.81	-
Error (b)	210	3,544.29	16.88	
Within Subjects	720	6,879.22		
A	3	194.20	64.73	7.19***
BA	6	112.23	18.71	2.08
DA	3	22.18	7.39	-
CA	12	238.57	19.88	2.21
BDA	6	30.03	5.01	-
BCA	24	370.47	15.44	1.72
DCA	12	95.10	7.93	-
BDCA	24	144.93	6.04	-
Error (w)	630	5,671.51	9.00	
Total	959	11,077.34		

B. INDIVIDUAL COMPARISONS

Comparison	$\overline{X}$	A1:6.47	A2:4.60	A3:4.34		A4:2.89	
A	Group	A1 = A2	A1 = A3	A1 > A4	A2 = A3	A2>A4	A3>A4
	Diff.	1.87	2.13	3.58	0.26	1.71	1.45
	t	1.686	1.978	3.416**	0.407	2.898**	2.767**

$^{**}p < .01$

$^{***}p < .001$

TABLE 36

COMPARISON OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING NON-VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	319	22	107.651***							
	B2		319	16								
	B3		319	48								
D	D1	1	479	37	44.975***	159	16	11.954***	14	1.641	79	98.221***
	D2		479	20		159	28		17		15	
C	C1	4	191	14	95.599***	63	18	121.153***	16	39.518***	7	138.195***
	C2		191	49		63	4		9		131	
	C3		191	35		63	56		30		20	
	C4		191	17		63	7		12		32	
	C5		191	27		63	22		7		45	
A	A1	3	239	66	226.492***	79	25	27.956***	25	18.396***	146	187.278***
	A2		239	19		79	25		16		16	
	A3		239	11		79	9		12		12	
	A4		239	19		79	29		10		18	

***$p < .001$

TABLE 37

DESCRIPTION OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING NON-VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	4	0	0	1	3	4	2	3	2	1	2	1
		C2	0	2	2	2	3	2	3	3	16	4	2	3
		C3	0	2	1	2	1	3	3	4	6	3	4	2
		C4	0	1	3	1	1	1	4	1	6	1	2	3
		C5	0	5	5	6	0	1	3	2	5	8	6	5
	D2	C1	1	2	0	2	2	4	2	3	1	3	3	2
		C2	1	2	2	2	2	2	2	3	0	1	2	2
		C3	6	9	2	7	5	8	4	4	3	1	4	3
		C4	0	2	2	3	2	2	3	2	2	1	3	2
		C5	2	2	2	1	0	1	1	2	0	6	4	6

TABLE 38

COMPARISON OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: DISCRIMINATION LEARNING NON-VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	1,564.77		
B	2	24.43	12.22	2.01
D	1	1.27	1.27	-
C	4	46.85	11.71	1.92
BD	2	28.21	14.11	2.32
BC	8	70.55	8.82	1.45
DC	4	69.81	17.45	2.87
BDC	8	45.34	5.67	-
Error (b)	210	1,278.31	6.09	
Within Subjects	720	1,861.28		
A	3	0.77	0.26	-
BA	6	26.92	4.49	1.85
DA	3	12.42	4.14	1.70
CA	12	53.44	4.45	1.83
BDA	6	48.60	8.10	3.33**
BCA	24	79.04	3.29	1.35
DCA	12	27.25	2.27	-
BDCA	24	59.63	2.48	1.02
Error (w)	630	1,532.11	2.43	
Total	959	3,426.05		

$^{**}p < .01$

TABLE 39

SUMMARY OF THE RESULTS OF THE COMPARISONS OF THE GROUPS IN TERMS OF THE RESPONSE MEASURES RELATED TO THE DISCRIMINATION LEARNING NON-VERBAL TASK

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			χ^2					F			
Response Measure			Att.	G.D. Ab.	G.D+	G.D-	Comparison	Att.	G.D. Ab.	G.D+	G.D-
Table			27	30	33	36		29	32	35	38
Comparison		B	.001	.001	.001	.001	B	.001[a]	N.S.	N.S.	N.S.
		D	.001	N.S.	.001	.001	D	N.S.	N.S.	N.S.	N.S.
		C	.001	.001	.001	.001	C	N.S.	.01[d]	N.S.	N.S.
		A	.001	.001	.001	.001	A	.001[b]	.001[e]	.001[f]	N.S.
	B1	D	N.S.	.001	.001	.001	BD	N.S.	N.S.	N.S.	N.S.
		C	N.S.	.001	.001	.001	BC	N.S.	N.S.	N.S.	N.S.
		A	.001	.001	.001	.001	DC	N.S.	N.S.	N.S.	N.S.
							BDC	N.S.	N.S.	N.S.	N.S.
	B2	D	.001	N.S.	N.S.	N.S.	BA	.001[c]	N.S.	N.S.	N.S.
		C	.001	.001	.001	.001	DA	N.S.	N.S.	N.S.	N.S.
		A	.001	.001	.001	.001	CA	N.S.	N.S.	N.S.	N.S.
							BDA	N.S.	N.S.	N.S.	.01[g]
	B3	D	N.S.	.001	N.S.	.001	BCA	N.S.	N.S.	N.S.	N.S.
		C	N.S.	.001	.001	.001	DCA	N.S.	N.S.	N.S.	N.S.
		A	.001	.001	.001	.001	BDCA	N.S.	N.S.	N.S.	N.S.

[a] B1<B2; B1<B3; B2<B3

[b] A1>A2; A1>A3; A1>A4; A2>A3; A2>A4; A3>A4

[c] B1A1<B2A1; B1A1<B3A1; B2A1=B3A1; B1A2<B2A2; B1A2<B3A2; B2A2=B3A2; B1A3<B2A3; B1A3<B3A3; B2A3=B3A3; B1A4<B2A4; B1A4<B3A4; B2A4=B3A4

[d] N.B.: Corresponding χ^2 occurs at $p < .001$

[e] A1>A2; A1>A3; A1>A4; A2=A3; A2=A4; A3=A4

[f] A1=A2; A1=A3; A1>A4; A2=A3; A2>A4; A3>A4

[g] N.B.: The χ^2's associated with the B, D, and A factors were significant while the corresponding F ratios were not; consequently, analyses of the simple effects associated with the BDA interaction were not considered warranted.

the overlap of levels, orientation of information, and trials. However, in view of the extreme heterogeneity of variance that was present in the scores in the classifications involved and the lack of differences among the means in the several classifications, the meaning of this BDA interaction is unclear and scrutiny of the simple effects was not considered to be indicated.

Direction of Goal Changes After Success or Failure

Table 40 consists of frequencies reflecting the number of times the subjects in the several groups did not change the direction of, raised, or lowered their goals after success or failure information was administered to them during their performance on the DLN. As a whole, over the trials in which the reinforcement information was administered, the several groups of subjects tended to respond in a similar fashion; i.e., the majority of times they raised their goals after success and lowered them after failure.

Rote Learning Verbal Task

Included in Tables 41 through 57 are statistics which reflect the subjects' learning performance and level of aspiration responses on the RLV. Tables 41, 42, and 43 include evidence pertinent to the attainment time scores; Tables 44, 45, and 46, to the number of responses scores; Tables 47, 48, and 49, to the absolute goal discrepancy scores; Tables 50, 51, and 52, to the positive goal discrepancy scores; and Tables 53, 54, and 55, to the negative goal discrepancy scores. Table 56 consists of the summary of the results of the statistical tests while Table 57 is composed of information about direction of goal changes after success or failure.

Learning Performance

Attainment Time

The data pertinent to the variability of the subjects' attainment times on the RLV are in Table 41 and Column 2 of Table 56. Extreme heterogeneity of variance existed among the subjects' attainment time scores within the several sections of trials. This was apparent when the total number of subjects was considered as a whole group and when each intelligence group was considered separately. In none of the other comparisons, over the total group or within each intelligence group, was there evidence that other than homogeneity of variance occurred.

TABLE 40

COMPARISON OF THE GROUPS IN TERMS OF DIRECTIONS OF GOAL CHANGE AFTER SUCCESS AND FAILURE: DISCRIMINATION LEARNING NON-VERBAL TASK (FREQUENCIES)

Comparison	Trial 3				Trial 4				Trial 11				Trial 12			
	Direction				Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	7	0	1	8	8	0	0	8	7	0	1	8	8	0	0	8
B1D1C2	6	1	1	8	8	0	0	8	7	0	1	8	7	0	1	8
B1D1C5	2	0	1	3	4	2	0	6	3	1	2	6	3	1	1	5
B1D2C1	6	1	1	8	6	1	1	8	6	1	1	8	7	0	1	8
B1D2C2	7	0	1	8	8	0	0	8	8	0	0	8	7	1	0	8
B1D2C5	5	1	1	7	5	1	0	6	4	1	0	5	5	0	0	5
B2D1C1	7	1	0	8	7	0	1	8	7	0	1	8	7	0	1	8
B2D1C2	7	0	1	8	6	0	2	8	7	0	1	8	5	2	1	8
B2D1C5	5	0	0	5	2	0	1	3	4	0	0	4	4	1	0	5
B2D2C1	5	1	2	8	6	2	0	8	7	0	1	8	6	1	1	8
B2D2C2	6	1	1	8	7	0	1	8	8	0	0	8	6	1	1	8
B2D2C5	5	0	0	5	3	0	0	3	7	0	0	7	3	0	1	4
B3D1C1	8	0	0	8	8	0	0	8	8	0	0	8	8	0	0	8
B3D1C2	7	1	0	8	8	0	0	8	7	1	0	8	8	0	0	8
B3D1C5	7	0	0	7	2	0	1	3	5	0	1	6	4	0	1	5
B3D2C1	6	0	2	8	6	0	2	8	6	0	2	8	6	0	2	8
B3D2C2	8	0	0	8	8	0	0	8	8	0	0	8	7	0	1	8
B3D2C5	5	0	0	5	4	0	0	4	6	0	1	7	1	2	1	4
	Trial 3				Trial 4				Trial 11				Trial 12			
	Direction				Direction				Direction				Direction			
	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T
B1D1C3	3	5	0	8	1	6	1	8	0	7	1	8	0	7	1	8
B1D1C4	1	5	2	8	1	5	2	8	0	7	1	8	0	8	0	8
B1D1C5	1	1	3	5	0	1	1	2	0	1	1	2	0	2	1	3
B1D2C3	0	7	1	8	1	5	2	8	1	6	1	8	0	7	1	8
B1D2C4	3	4	1	8	1	7	0	8	1	7	0	8	1	7	0	8
B1D2C5	1	0	0	1	1	1	0	2	0	0	3	3	0	1	2	3
B2D1C3	0	7	1	8	1	6	1	8	5	3	0	8	1	6	1	8
B2D1C4	1	5	2	8	1	6	1	8	2	4	2	8	2	4	2	8
B2D1C5	1	2	0	3	0	5	0	5	0	4	0	4	1	2	0	3
B2D2C3	0	7	1	8	2	5	1	8	2	5	1	8	1	7	0	8
B2D2C4	0	6	2	8	1	6	1	8	2	6	0	8	1	6	1	8
B2D2C5	0	2	1	3	0	3	2	5	0	0	1	1	0	4	0	4
B3D1C3	0	6	2	8	0	6	2	8	1	3	3	8	0	5	3	8
B3D1C4	0	7	1	8	2	5	1	8	1	6	1	8	1	7	0	8
B3D1C5	0	1	0	1	1	3	1	5	0	2	0	2	1	2	0	3
B3D2C3	1	5	2	8	1	7	0	8	1	4	3	8	2	6	0	8
B3D2C4	2	6	0	8	0	7	1	8	1	7	0	8	2	6	0	8
B3D2C5	0	3	0	3	0	4	0	4	0	1	0	1	3	1	0	4

TABLE 40--Continued

Comparison	Trial 5				Trial 8				Trial 9				Trial 13			
	Direction				Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	8	0	0	8	8	0	0	8	8	0	0	8	8	0	0	8
B1D1C2	6	0	2	8	7	0	1	8	8	0	0	8	6	1	1	8
B1D1C3	7	0	1	8	8	0	0	8	8	0	0	8	8	0	0	8
B1D1C5	4	0	1	5	4	0	2	6	4	0	1	5	2	1	1	4
B1D2C1	6	1	1	8	6	1	1	8	6	1	1	8	6	1	1	8
B1D2C2	8	0	0	8	8	0	0	8	8	0	0	8	6	2	0	8
B1D2C3	7	0	1	8	6	2	0	8	7	1	0	8	7	0	1	8
B1D2C5	3	0	0	3	3	0	1	4	2	1	0	3	6	0	0	6
B2D1C1	7	0	1	8	6	1	1	8	6	1	1	8	7	0	1	8
B2D1C2	6	0	2	8	7	0	1	8	7	0	1	8	6	1	1	8
B2D1C3	7	0	1	8	6	0	2	8	5	2	1	8	7	0	1	8
B2D1C5	5	0	0	5	2	1	0	3	2	2	0	4	3	1	0	4
B2D2C1	7	1	0	8	6	0	2	8	7	0	1	8	7	0	1	8
B2D2C2	6	1	1	8	5	1	2	8	6	1	1	8	7	0	1	8
B2D2C3	5	3	0	8	3	3	2	8	7	1	0	8	5	0	3	8
B2D2C5	4	0	0	4	3	0	0	3	4	0	0	4	2	0	0	2
B3D1C1	8	0	0	8	8	0	0	8	8	0	0	8	8	0	0	8
B3D1C2	7	1	0	8	5	1	2	8	8	0	0	8	6	1	1	8
B3D1C3	6	1	1	8	6	0	2	8	5	1	2	8	4	2	2	8
B3D1C5	6	1	0	7	4	2	0	6	3	0	1	4	4	1	1	6
B3D2C1	6	1	1	8	5	1	2	8	6	0	2	8	6	0	2	8
B3D2C2	8	0	0	8	8	0	0	8	8	0	0	8	7	0	0	1
B3D2C3	6	0	2	8	7	0	1	8	6	2	0	8	7	0	1	8
B3D2C5	5	0	1	6	6	1	0	7	2	0	0	2	2	1	0	3

	Trial 6				Trial 7				Trial 10				Trial 14			
	Direction				Direction				Direction				Direction			
	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T
B1D1C2	1	6	1	8	1	5	2	8	1	6	1	8	3	3	2	8
B1D1C3	0	4	4	8	1	6	1	8	0	4	4	8	0	7	1	8
B1D1C4	0	6	2	8	0	6	2	8	0	8	0	8	0	7	1	8
B1D1C5	1	1	0	2	0	2	0	2	0	4	1	5	0	3	0	3
B1D2C2	0	6	2	8	1	6	1	8	0	6	2	8	0	5	3	8
B1D2C3	1	6	1	8	4	4	0	8	0	7	1	8	3	4	1	8
B1D2C4	4	3	1	8	1	7	0	8	4	4	0	8	1	6	1	8
B1D2C5	1	2	2	5	1	0	2	3	0	3	1	4	1	2	3	6
B2D1C2	1	6	1	8	0	6	2	8	2	6	0	8	1	6	1	8
B2D1C3	0	6	2	8	0	7	1	8	1	5	2	8	0	7	1	8
B2D1C4	1	6	1	8	2	5	1	8	2	6	0	8	0	5	3	8
B2D1C5	2	5	1	8	2	3	0	5	1	1	0	2	1	4	0	5
B2D2C2	0	6	2	8	1	7	0	8	0	8	0	8	0	8	0	8
B2D2C3	2	3	3	8	0	7	1	8	1	6	1	8	2	5	1	8
B2D2C4	0	6	2	8	1	6	1	8	1	5	2	8	2	6	0	8
B2D2C5	0	4	2	6	2	1	0	3	0	3	0	3	1	5	0	6
B3D1C2	1	6	1	8	0	6	2	8	0	7	1	8	0	8	0	8
B3D1C3	0	6	2	8	0	5	3	8	0	5	3	8	0	5	3	8
B3D1C4	1	6	1	8	0	6	2	8	1	7	0	8	1	7	0	8
B3D1C5	0	1	1	2	0	0	1	1	0	1	0	1	1	1	0	2
B3D2C2	0	5	3	8	0	8	0	8	1	4	3	8	0	6	2	8
B3D2C3	0	6	2	8	1	5	2	8	1	7	0	8	2	5	1	8
B3D2C4	1	4	3	8	0	7	1	8	1	7	0	8	1	7	0	8
B3D2C5	1	1	1	3	0	6	0	6	0	1	0	1	1	2	0	3

TABLE 40--Continued

Comparison	Trial 15				Trial 16				Trial 17			
	Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	8	0	0	8	8	0	0	8	8	0	0	8
B1D1C2	5	1	2	8	6	0	2	8	6	1	1	8
B1D1C3	5	0	3	8	6	0	2	8	7	0	1	8
B1D1C4	8	0	0	8	8	0	0	8	8	0	0	8
B1D1C5	2	3	0	5	3	1	1	5	5	0	1	6
B1D2C1	7	1	0	8	6	2	0	8	6	2	0	8
B1D2C2	7	0	1	8	8	0	0	8	6	0	2	8
B1D2C3	5	1	2	8	7	1	0	8	5	1	2	8
B1D2C4	6	2	0	8	7	1	0	8	5	3	0	8
B1D2C5	3	1	1	5	3	0	0	3	2	0	1	3
B2D1C1	7	1	0	8	7	0	1	8	6	0	2	8
B2D1C2	8	0	0	8	6	2	0	8	6	1	1	8
B2D1C3	5	2	1	8	6	2	0	8	7	1	0	8
B2D1C4	6	1	1	8	6	0	2	8	7	0	1	8
B2D1C5	6	0	0	6	4	0	0	4	4	0	0	4
B2D2C1	5	1	2	8	7	0	1	8	7	0	1	8
B2D2C2	7	1	0	8	7	1	0	8	6	2	0	8
B2D2C3	8	0	0	8	5	0	3	8	7	0	1	8
B2D2C4	6	0	2	8	7	0	1	8	8	0	0	8
B2D2C5	2	0	1	3	4	0	0	4	3	0	0	3
B3D1C1	8	0	0	8	8	0	0	8	8	0	0	8
B3D1C2	5	2	1	8	7	1	0	8	7	1	0	8
B3D1C3	5	0	3	8	5	1	2	8	5	0	3	8
B3D1C4	7	0	1	8	6	1	1	8	7	0	1	8
B3D1C5	4	1	1	6	4	0	1	5	6	0	1	7
B3D2C1	7	0	1	8	7	0	1	8	7	0	1	8
B3D2C2	7	1	0	8	8	0	0	8	8	0	0	8
B3D2C3	7	0	1	8	6	1	1	8	6	0	2	8
B3D2C4	5	1	2	8	7	0	1	8	7	1	0	8
B3D2C5	2	0	2	4	4	0	1	5	3	0	2	5

TABLE 41

COMPARISON OF THE GROUPS IN TERMS OF ATTAINMENT TIME: ROTE LEARNING VERBAL TASK (VARIANCES, ROUNDED)

Compari-son	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	383	157	0.185							
	B2		383	151								
	B3		383	150								
D	D1	1	575	151	2.015	191	145	0.534	153	0.080	141	0.623
	D2		575	170		191	161		146		158	
C	C1	5	191	145	1.359	63	133	3.745	139	2.481	149	0.799
	C2		191	167		63	152		169		148	
	C3		191	160		63	186		121		157	
	C4		191	156		63	145		163		135	
	C5		191	167		63	187		142		165	
	C6		191	161		63	135		162		141	
A	A1	3	287	49	52.248***	95	37	38.967***	48	15.242**	53	10.408
	A2		287	109		95	94		102		96	
	A3		287	105		95	121		94		71	
	A4		287	96		95	130		77		57	

**$p < .01$

***$p < .001$

Tables 42 and 43 and Column 8 of Table 56 consist of information about the central tendencies in the subjects' attainment time scores on the RLV. There were differences among the means of the scores in the several sections of trials; the mean of each section was smaller than those of the preceding sections.

Also, there were differences among the means of the intelligence groups. The retarded subjects had a higher mean attainment time than did the normal and superior subjects; the normal and superior subjects had equivalent mean attainment times. Differences occurred among the means of cells formed by the overlap of levels and trials. Further scrutiny revealed the following pattern of relationships. On each of the four sections of trials, the mean of the retarded group was larger than those of the normal and superior groups; the means of the normal and superior groups remained equivalent.

Differences also were present among the means of the groups defined by the combination of level and orientation. More discrete analyses indicated that the extant relationships were these: within the individual orientation, the mean of the retarded group equalled that of the normal group and exceeded that of the superior group, and the mean of the normal group was larger than that of the superior group. Within the group orientation, the mean of the retarded group was larger than those of the normal and superior groups while the means of these latter groups were equivalent.

In addition, there were differences among the means of the cells defined by the combination of the level, orientation, and trial factors. Subsequent analyses revealed that the following relationships obtained. Within the individual orientation, on all four sections of trials, the retarded and normal groups and the normal and superior groups had equivalent means; on the first three sections of trials, the mean of the retarded group was larger than that of the superior group and, on the last section, the means of these groups were equal. Within the group orientation, on all four sections of trials, the mean of the retarded group was larger than that of the normal group while the means of the normal and superior groups were equivalent; on the first section of trials, the means of the retarded and superior groups were equivalent and on the latter three sections, the mean of the retarded group was larger than that of the superior group.

Other than in the instances cited above, no differences were apparent among the means of the treatment groups or of the groups formed by the several combinations of treatments, trials, and/or levels.

TABLE 42

DESCRIPTION OF THE GROUPS IN TERMS OF ATTAINMENT TIME: ROTE LEARNING VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	**A1**	**A2**	**A3**	**A4**	**A1**	**A2**	**A3**	**A4**	**A1**	**A2**	**A3**	**A4**
Condition	D1	C1	43	34	25	20	40	25	17	13	32	21	15	13
		C2	40	28	20	17	39	27	21	18	38	23	16	13
		C3	42	31	21	19	38	26	21	18	39	26	20	17
		C4	43	32	23	17	39	25	21	14	36	23	16	14
		C5	38	25	15	12	39	26	22	18	36	20	16	15
		C6	44	33	25	21	42	30	23	18	36	22	14	14
	D2	C1	40	31	25	21	40	28	20	18	42	31	23	19
		C2	41	31	26	23	30	13	10	8	36	20	13	10
		C3	43	36	32	31	39	27	22	19	40	32	20	16
		C4	42	34	29	26	38	29	24	18	39	27	17	13
		C5	44	34	26	24	34	18	13	12	39	28	18	15
		C6	42	35	29	26	37	22	16	16	38	23	17	13

TABLE 43

COMPARISON OF THE GROUPS IN TERMS OF ATTAINMENT TIME: ROTE LEARNING VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	287	10,820.28		
B	2	1,198.69	599.35	18.51^{***}
D	1	58.40	58.40	1.80
C	5	348.81	69.76	2.15
BD	2	319.63	159.82	4.94^{**}
BC	10	109.25	10.93	-
DC	5	225.54	45.11	1.39
BDC	10	399.81	39.98	1.22
Error (b)	252	8,160.15	32.38	
Within Subjects	864	12,327.56		
A	3	10,243.93	3,414.64	$1{,}491.11^{***}$
BA	6	65.53	10.92	4.77^{***}
DA	3	16.50	5.50	2.40
CA	15	36.90	2.46	1.07
BDA	6	113.41	18.90	8.25^{***}
BCA	30	59.54	1.98	-
DCA	15	17.63	1.18	-
BDCA	30	42.18	1.41	-
Error (w)	756	1,731.94	2.29	
Total	1,151	23,147.84		

TABLE 43--Continued

B. INDIVIDUAL COMPARISONS

Comparison	$\bar{X}$	B1:29.98	B2:24.40	B3:23.42			
	Group	B1 ≯ B2	B1 > B3	B2 = B3			
B	Diff.	5.58	6.56	0.98			
	t	6.270***	7.371***	1.114			
	$\bar{X}$	A1:39.11	A2:27.11	A3:20.31	A4:17.19		
	Group	A1 > A2	A1 > A3	A1 > A4	A2 > A3	A2 > A4	A3 > A4
A	Diff.	12.00	18.80	21.92	6.80	9.92	3.12
	t	16.216***	25.753***	30.873***	7.907***	11.810***	3.759***
	$\bar{X}$	B1D1:27.83	B2D1:25.75	B3D1:22.21	B1D2:32.06	B2D2:22.94	
	Group	B1D1=B2D1	B1D1>B3D1	B2D1>B3D1	B1D2>B2D2	B1D2>B3D2	
	Diff.	2.08	5.62	3.54	9.12	7.44	
	t	1.677	4.606***	2.855**	7.238***	5.767***	
BD	$\bar{X}$	B3D2:24.62					
	Group	B2D2=B3D2					
	Diff.	1.68					
	t	1.333					
	$\bar{X}$	B1A1:41.83	B2A1:37.91	B3A1:37.58	B1A2:32.00	B2A2:24.67	
	Group	B1A1>B2A1	B1A1>B3A1	B2A1=B3A1	B1A2>B2A2		
	Diff.	3.92	4.25	0.33	7.33		
	t	4.170***	4.381***	0.320	5.090***		
	$\bar{X}$	B3A2:24.67	B1A3:24.67	B2A3:19.17	B3A3:17.83		
	Group	B1A2>B3A2	B2A2=B3A2	B1A3>B2A3	B1A3>B3A3		
BA	Diff.	7.33	0.00	5.50	6.84		
	t	5.199***	-	3.667***	4.817***		
	$\bar{X}$	B1A4:21.41	B2A4:15.83	B3A4:14.33			
	Group	B2A3=B3A3	B1A4>B2A4	B1A4>B3A4	B2A4=B3A4		
	Diff.	1.34	5.58	7.08	1.50		
	t	1.015	3.875***	5.057***	1.316		

TABLE 43--*Continued*

Compar-ison	$\bar{X}$	B1D1A1:41.56	B2D1A1:39.44	B3D1A1:36.06	B1D2A1:42.04
BDA	Group	B1D1A1=B2D1A1	B1D1A1>B3D1A1	B2D1A1=B3D1A1	B1D2A1>B2D2A1
	Diff.	2.12	5.50	3.38	5.62
	t	1.752	3.929***	2.414	3.958***
	$\bar{X}$	B2D2A1:36.42	B3D2A1:39.10	B1D1A2:30.54	B2D1A2:26.42
	Group	B1D2A1=B3D2A1	B2D2A1=B3D2A1	B1D1A2=B2D1A2	B1D1A2>B3D1A2
	Diff.	2.94	2.68	4.12	8.16
	t	2.227	1.861	2.233	4.459***
	$\bar{X}$	B3D1A2:22.38	B1D2A2:33.56	B2D2A2:22.81	B3D2A2:27.00
	Group	B2D1A2=B3D1A2	B1D2A2>B2D2A2	B1D2A2>B3D2A2	B2D2A2=B3D2A2
	Diff.	4.04	10.75	6.56	4.19
	t	2.030	4.977***	3.169**	2.095
	$\bar{X}$	B1D1A3:21.42	B2D1A3:20.79	B3D1A3:16.08	B1D2A3:27.73
	Group	B1D1A3=B2D1A3	B1D1A3>B3D1A3	B2D1A3=B3D1A3	B1D2A3>B2D2A3
	Diff.	0.63	5.34	4.71	10.40
	t	0.328	3.141**	2.519	4.727***
	$\bar{X}$	B2D2A3:17.33	B3D2A3:18.06	B1D1A4:17.81	B2D1A4:16.35
	Group	B1D2A3>B3D2A3	B2D2A3=B3D2A3	B1D1A4=B2D1A4	B1D1A4=B3D1A4
	Diff.	9.67	0.71	1.46	3.50
	t	4.456***	0.221	0.829	2.110
	$\bar{X}$	B3D1A4:14.31	B1D2A4:24.90	B2D2A4:15.21	B3D2A4:14.29
	Group	B2D1A4=B3D1A4	B1D2A4>B2D2A4	B1D2A4>B3D2A4	B2D2A4=B3D2A4
	Diff.	2.04	9.69	10.61	0.92
	t	1.221	4.903***	4.845***	0.551

$^{**}p < .01$

$^{***}p < .001$

Number of Responses

The relationships among the variances of the subjects' number of responses scores on the RLV are reflected in the data of which Table 44 and Column 3 of Table 56 are composed. Over the total group of subjects, extreme heterogeneity occurred in the subjects' scores when they were classified according to trials and homogeneity of variance was present when the scores were categorized according to levels, orientation, and type-frequency. This same pattern was apparent within the retarded group. However, within the normal and superior groups, equivalent variances existed in the scores in all three classifications: orientation, type-frequency, and trials.

Evidence relevant to the subjects' mean number of responses to the items of the RLV is contained in Tables 45 and 46 and Column 9 of Table 56. Here, as in the attainment time scores, differences occurred among levels and among trials. The mean of each section of trials was smaller than those of the preceding sections, and the retarded subjects had a higher mean number of responses than the normal and superior subjects who had equivalent means. Also, differences occurred among the means of scores in the cells defined by the overlap of trials and levels and of levels, orientations, and trials. Further analyses of the differences related to the BA interaction revealed that these relationships obtained. Consistent with the relationships apparent in the attainment time scores, on all four sections of trials, the mean of the retarded group was larger than those of the normal and superior groups; and, the means of the normal and superior groups were equivalent. Subsequent scrutiny of the differences involved in the significant BDA interaction led to the isolation of the following relationships. Within the individual orientation, on all four sections of trials, the means of the retarded and normal groups and the normal and superior groups were equivalent; the means of the retarded group were larger than those of the superior group. Within the group orientation, on all four sections of trials, the means of the retarded group exceeded those of the normal group while the normal and the superior groups had equivalent means; on the first section of trials, the means of the retarded and superior groups did not differ but on the three latter sections they did--the retarded group had the larger mean in each comparison.

Differences among means did not occur in any other comparison.

Level of Aspiration Responses

Absolute Goal Discrepancy Scores

Table 47 and Column 4 of Table 56 includes information about the variability of the subjects' absolute goal discrepancy scores on the RLV. Over the total group, homogeneity of variance

TABLE 44

COMPARISON OF THE GROUPS IN TERMS OF NUMBER OF RESPONSES: ROTE LEARNING VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	383	20	1,929							
	B2		383	19								
	B3		383	17								
D	D1	1	575	19	1.950	191	18	1.816	19	0.613	16	0.528
	D2		575	21		191	21		17		18	
C	C1	5	191	18	1.552	63	16	3.936	17	3.154	18	0.834
	C2		191	19		63	18		20		15	
	C3		191	20		63	25		15		19	
	C4		191	21		63	20		20		17	
	C5		191	19		63	23		16		18	
	C6		191	21		63	19		21		17	
A	A1	3	287	8	21.112***	95	6	26.131***	9	5.024	8	15.760**
	A2		287	14		95	14		13		11	
	A3		287	13		95	16		11		7	
	A4		287	11		95	15		8		5	

**$p < .01$

***$p < .001$

TABLE 45

DESCRIPTION OF THE GROUPS IN TERMS OF NUMBER OF RESPONSES: ROTE LEARNING VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	17	14	11	9	14	10	8	6	13	9	7	6
		C2	16	12	9	8	15	11	9	8	15	10	8	6
		C3	17	12	10	9	15	11	9	7	16	11	9	8
		C4	17	13	10	8	15	10	9	6	14	9	7	6
		C5	15	11	7	6	15	11	10	8	14	9	8	7
		C6	17	12	10	9	16	12	9	8	14	9	6	6
	D2	C1	16	13	10	9	16	12	9	8	17	13	10	8
		C2	16	12	11	10	12	6	5	5	14	9	7	6
		C3	17	15	13	13	16	12	9	9	16	13	8	8
		C4	17	13	12	11	15	12	10	8	15	10	8	6
		C5	18	14	11	10	13	8	6	6	16	12	8	7
		C6	16	14	12	10	15	9	7	7	15	10	8	6

TABLE 46

COMPARISON OF THE GROUPS IN TERMS OF NUMBER OF RESPONSES: ROTE LEARNING VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	287	1,351.61		
B	2	165.02	82.51	20.79***
D	1	12.10	12.10	3.05
C	5	40.59	8.12	2.05
BD	2	29.77	14.89	3.75
BC	10	17.42	1.74	–
DC	5	26.00	5.20	1.31
BDC	10	59.42	5.94	1.50
Error (b)	252	1,001.29	3.97	
Within Subjects	864	1,491.25		
A	3	1,212.83	404.28	1,304.13***
BA	6	6.24	1.04	3.35**
DA	3	1.98	0.66	2.13
CA	15	5.04	0.34	1.10
BDA	6	12.49	2.08	6.71***
BCA	30	6.81	0.23	–
DCA	15	3.63	0.24	–
BDCA	30	4.76	0.16	–
Error (w)	756	237.47	0.31	
Total	1,151	2,842.86		

TABLE 46--Continued

B. INDIVIDUAL COMPARISONS							
Comparison	$\bar{X}$	B1:12.33	B2:10.15	B3:9.94			
B	Group	B1 > B2	B1 > B3	B2 = B3			
	Diff.	2.18	2.39	0.21			
	t	6.812***	7.967***	0.700			
A	$\bar{X}$	A1:15.42	A2:11.19	A3:8.89	A4:7.72		
	Group	A1 > A2	A1 > A3	A1 > A4	A2 > A3	A2 > A4	A3 > A4
	Diff.	4.23	6.53	7.70	2.30	3.47	1.11
	t	15.107***	23.321***	29.615***	7.188***	11.567***	3.700***
BA	$\bar{X}$	B1A1:16.58	B2A1:14.75	B3A1:14.92			
	Group	B1A1 > B2A1	B1A1 > B3A1	B2A1 = B3A1			
	Diff.	1.83	1.66	0.17			
	t	4.692***	4.486***	0.415			
	$\bar{X}$	B1A2:12.91	B2A2:10.33	B3A2:10.33			
	Group	B1A2 > B2A2	B1A2 > B3A2	B2A2 = B3A2			
	Diff.	2.58	2.58	0.00			
	t	4.777***	5.059***	-			
	$\bar{X}$	B1A3:10.50	B2A3:8.33	B3A3:7.83			
	Group	B1A3 > B2A3	B1A3 > B3A3	B2A3 = B3A3			
	Diff.	2.17	2.67	0.50			
	t	4.094***	5.449***	0.934			
	$\bar{X}$	B1A4:9.33	B2A4:7.17	B3A4:6.67			
	Group	B1A4 > B2A4	B1A4 > B3A4	B2A4 = B3A4			
	Diff.	2.14	2.66	0.50			
	t	4.367***	5.783***	1.389			

TABLE 46--Continued

Comparison				
BDA	$\overline{X}$	B1D1A1:16.46	B2D1A1:15.21	B3D1A1:14.21
	Group	B1D1A1 = B2D1A1	B1D1A1 > B3D1A1	B2D1A1 = B3D1A1
	Diff.	1.25	2.25	1.00
	t	2.315	4.245^{***}	1.639
	$\overline{X}$	B1D2A1:16.58	B2D2A1:14.44	B3D2A1:15.46
	Group	B1D2A1 > B2D2A1	B1D2A1 = B3D2A1	B2D2A1 = B3D2A1
	Diff.	2.14	1.12	1.02
	t	3.689^{***}	2.074	1.789
	$\overline{X}$	B1D1A2:12.31	B2D1A2:10.71	B3D1A2:9.46
	Group	B1D1A2 = B2D1A2	B1D1A2 > B3D1A2	B2D1A2 = B3D1A2
	Diff.	1.60	2.85	1.25
	t	2.319	4.385^{***}	1.712
	$\overline{X}$	B1D2A2:13.40	B2D2A2:9.73	B3D2A2:11.10
	Group	B1D2A2 > B2D2A2	B1D2A2 > B3D2A2	B2D2A2 = B3D2A2
	Diff.	3.67	2.30	1.37
	t	4.645^{***}	3.026^{**}	2.045
	$\overline{X}$	B1D1A3:9.38	B2D1A3:8.79	B3D1A3:7.29
	Group	B1D1A3 = B2D1A3	B1D1A3 > B3D1A3	B2D1A3 = B3D1A3
	Diff.	0.59	2.09	1.50
	t	0.894	3.667^{***}	2.419
	$\overline{X}$	B1D2A3:11.56	B2D2A3:7.88	B3D2A3:8.15
	Group	B1D2A3 > B2D2A3	B1D2A3 > B3D2A3	B2D2A3 = B3D2A3
	Diff.	3.68	3.41	0.27
	t	4.718^{***}	4.487^{***}	0.450
	$\overline{X}$	B1D1A4:8.23	B2D1A4:7.42	B3D1A4:6.69
	Group	B1D1A4 = B2D1A4	B1D1A4 > B3D1A4	B2D1A4 = B3D1A4
	Diff.	0.81	1.54	0.73
	t	1.373	3.080^{**}	1.377
	$\overline{X}$	B1D2A4:10.54	B2D2A4:7.35	B3D2A4:6.92
	Group	B1D2A4 > B2D2A4	B1D2A4 > B3D2A4	B2D2A4 = B3D2A4
	Diff.	3.19	3.62	0.43
	t	4.143^{***}	4.892^{***}	0.827

$^{**}p < .01$

$^{***}p < .001$

TABLE 47

COMPARISON OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: ROTE LEARNING VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	X^2	N-1	S^2	X^2	S^2	X^2	S^2	X^2
B	B1	2	319	54	486.880***							
	B2		319	144								
	B3		319	9								
D	D1	1	479	76	4.587	159	12	149.189***	207	33.242***	8	5.347
	D2		479	63		159	95		81		11	
C	C1	4	191	22	665.072***	63	47	190.834***	10	450.936***	10	2.314
	C2		191	8		63	12		5		8	
	C3		191	13		63	22		8		9	
	C4		191	207		63	178		431		9	
	C5		191	94		63	10		251		11	
A	A1	3	239	100	291.175***	79	178	270.853***	103	115.555***	18	36.882***
	A2		239	23		79	11		51		6	
	A3		239	131		79	12		373		6	
	A4		239	23		79	11		51		6	

***$p < .001$

occurred in the scores of the subjects in the two orientation groups but heterogeneity of variance existed in the scores when they were categorized according to level, type-frequency, and trials. Within the retarded and normal groups, there are consistent relationships; viz, extreme heterogeneity of variance was apparent in the scores categorized according to orientation, type-frequency, and trials. On the other hand, within the superior group, such heterogeneity was apparent only in the several sections of trials; the variances of the scores of the subjects receiving the two orientation and six type-frequency sets of information were equivalent.

Data pertinent to the mean absolute goal discrepancy scores related to RLV performance are listed in Tables 48 and 49 and Column 10 of Table 56. There were no differences among the means of the subjects' absolute goal discrepancy scores when these scores are grouped according to the several levels, treatments, trials, or the various combinations of these.

Positive Goal Discrepancy Scores

Table 50 and Column 5 of Table 56 consist of the statistics related to the variability of the subjects' positive goal discrepancy scores as they responded to the RLV. Over the total group of subjects, there was equivalent variability of the scores of the subjects in the two orientation groups. On the other hand, extreme heterogeneity occurred in the subjects' scores when they are grouped according to level, type-frequency, and trials. Within the retarded group, there was extreme heterogeneity of variance in all comparisons--the two treatments and trials. Within the normal group, there was again heterogeneity in the scores of the subjects who received the six sets of type-frequency information and in the scores in the four sections of trials. On the other hand, equivalent variability occurred in the scores of the subjects in the two orientation groups. This pattern was reversed in the superior group; viz, heterogeneity of variance was associated with the two orientations and there was equivalent variability in the scores of the subjects in the six type-frequency groups and in the scores in the four sections of trials.

In Tables 51 and 52 and Column 11 of Table 56 appear the data reflecting the central tendencies of the subjects' positive goal discrepancy scores pertinent to the RLV. There were no differences among the means of the subjects categorized according to levels, treatments, trials, or any combination of these.

Negative Goal Discrepancy Scores

Table 53 and Column 6 of Table 56 include information about the variances of the subjects' negative goal discrepancy scores during RLV performance. Over the total group, there was equivalent variability in the scores of the subjects to whom were administered the two orientations. On the other hand, there was extreme heterogeneity of variance in the subjects'

TABLE 48

DESCRIPTION OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: ROTE LEARNING VERBAL TASK (MEANS, ROUNDED)

	Level	B1				B2				B3			
	Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
D1	C1	3	3	4	4	5	2	3	4	4	4	4	3
	C2	7	4	4	4	4	4	4	4	2	3	3	4
	C3	5	6	4	4	6	3	4	3	7	3	4	4
	C4	3	3	3	2	4	6	20	4	2	3	5	4
	C5	4	5	3	2	13	9	10	9	2	5	3	3
D2	C1	13	3	3	4	6	3	3	4	6	3	4	5
	C2	3	4	6	5	2	3	2	3	3	4	4	4
	C3	6	4	6	4	3	3	4	3	5	3	3	4
	C4	22	5	6	5	4	6	15	6	2	4	6	2
	C5	2	3	4	4	7	5	6	5	6	3	3	2

TABLE 49

COMPARISON OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: ROTE LEARNING VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	4,192.40		
B	2	49.16	24.58	1.38
D	1	1.58	1.58	-
C	4	70.20	17.55	-
BD	2	44.80	22.40	1.25
BC	8	161.94	20.24	1.13
DC	4	52.23	13.06	-
BDC	8	58.91	7.36	-
Error (b)	210	3,753.58	17.87	
Within Subjects	720	4,120.25		
A	3	48.77	16.26	2.94
BA	6	58.31	9.72	1.75
DA	3	9.05	3.02	-
CA	12	104.67	8.72	1.57
BDA	6	32.77	5.46	-
BCA	24	222.46	9.27	1.67
DCA	12	50.95	4.25	-
BDCA	24	103.80	4.33	-
Error (w)	630	3,489.47	5.54	
Total	959	8,312.65		

TABLE 50

COMPARISON OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: ROTE LEARNING VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	s^2	χ^2	N-1	s^2	χ^2	s^2	χ^2	s^2	χ^2
B	B1	2	319	21	465.361***							
	B2		319	105								
	B3		319	10								
D	D1	1	479	48	1.537	159	12	33.535***	125	5.705	6	24.215***
	D2		479	43		159	30		85		13	
C	C1	4	191	7	595.624***	63	7	83.662***	4	442.550***	11	8.313
	C2		191	10		63	11		4		13	
	C3		191	11		63	18		9		7	
	C4		191	98		63	54		232		8	
	C5		191	98		63	13		259		10	
A	A1	3	239	47	61.354***	79	27	20.946***	100	33.201***	13	6.566
	A2		239	22		79	15		41		9	
	A3		239	59		79	12		154		10	
	A4		239	53		79	27		124		7	

***$p < .001$

TABLE 51

DESCRIPTION OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: ROTE LEARNING VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	2	2	3	4	1	1	1	2	2	2	2	1
		C2	1	4	4	2	1	3	2	2	1	3	3	4
		C3	1	6	4	2	4	3	3	2	1	2	3	2
		C4	2	3	3	2	0	3	10	2	2	3	3	4
		C5	2	6	3	2	13	8	9	9	1	1	2	2
	D2	C1	2	2	3	4	2	2	1	1	4	1	4	3
		C2	2	5	6	3	2	2	2	2	1	4	4	2
		C3	2	2	3	2	2	3	4	2	3	3	4	1
		C4	8	3	5	6	2	3	12	12	1	5	3	1
		C5	0	1	2	2	4	2	6	2	5	2	2	1

TABLE 52

COMPARISON OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: ROTE LEARNING VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	3,267.19		
B	2	40.39	20.20	1.47
D	1	10.00	10.00	-
C	4	56.18	14.05	1.02
BD	2	5.60	2.80	-
BC	8	129.98	16.25	1.18
DC	4	62.03	15.51	1.13
BDC	8	71.18	8.90	-
Error (b)	210	2,891.83	13.77	
Within Subjects	720	2,158.56		
A	3	32.22	10.74	3.62
BA	6	15.59	2.60	-
DA	3	8.24	2.75	-
CA	12	50.91	4.24	1.43
BDA	6	15.67	2.61	-
BCA	24	102.69	4.28	1.44
DCA	12	11.65	0.97	-
BDCA	24	53.12	2.21	-
Error (w)	630	1,868.47	2.97	
Total	959	5,425.75		

TABLE 53

COMPARISON OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: ROTE LEARNING VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	s^2	χ^2	N-1	s^2	χ^2	s^2	χ^2	s^2	χ^2
B	B1	2	319	52	402.234***							
	B2		319	154								
	B3		319	10								
D	D1	1	479	71	0.057	159	12	142.807***	192	9.769**	10	0.179
	D2		479	73		159	92		117		11	
C	C1	4	191	25	932.584***	63	49	186.518***	13	517.929***	12	4.986
	C2		191	10		63	16		7		7	
	C3		191	17		63	22		17		11	
	C4		191	297		63	169		703		11	
	C5		191	12		63	7		19		10	
A	A1	3	239	67	660.555***	79	170	266.060***	16	429.850***	13	9.059
	A2		239	14		79	12		24		7	
	A3		239	197		79	18		561		11	
	A4		239	9		79	7		11		9	

**$p < .01$

***$p < .001$

scores when they were classified according to levels, type-frequency of information, and sections of trials. Within the retarded and normal groups, there was a consistent pattern of relationships: heterogeneity of variance existed among the scores of the subjects when they were categorized according to the two treatments and according to trials. Conversely, within the superior group, equivalent score variability was manifested in each comparison.

The relationships among subjects' mean negative goal discrepancy scores on the RLV are reflected in the data included in Tables 54 and 55 and in Column 12 of Table 56. Here the pattern of relationships was the same as that apparent in the absolute and positive goal discrepancy scores: no differences occurred among the means of the groups compared in any analysis.

Direction of Goal Changes After Success and Failure

The data pertinent to the direction in which the subjects altered their goals after they received success or failure information on the RLV appear in Table 57. No differences were evident among the frequencies of the subjects in the groups compared who changed their goals in the several directions. The subjects responded in a similar manner to success and failure information insofar as direction of goal changes were concerned; viz, they tended to raise their goals after success and to lower them after failure.

Rote Learning Non-Verbal Task

The results of the analyses of the subjects' learning performance and level of aspiration responses on the RLN are listed in Tables 58 through 71. In Tables 58, 59, and 60 is included information about the attainment time scores; in Tables 61, 62, and 63, about the absolute goal discrepancy scores; in Tables 64, 65, and 66, about the positive goal discrepancy scores; and in Tables 67, 68, and 69, about the negative goal discrepancy scores. The summary of the results of these analyses appears in Table 70. Data relevant to direction of goal changes are contained in Table 71.

Learning Performance

Attainment Time

Information about the Bartlett tests of the homogeneity of the variance of the attainment scores on the RLN is in Table 58 and Column 2 of Table 70. Considering first the group of subjects as a whole, extreme heterogeneity of variance existed among the subjects' scores when they were classified according to levels, orientation, type-frequency, and trials. The pattern of relaships apparent within the normal group was consistent with this. This was not the case within the retarded and superior groups. Within the retarded group, heterogeneity of variance was not

TABLE 54

DESCRIPTION OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: ROTE LEARNING VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	1	1	2	1	5	2	2	2	2	3	3	2
		C2	6	3	3	4	3	4	3	3	1	1	3	2
		C3	4	4	3	2	1	2	6	2	5	3	4	5
		C4	1	1	1	0	4	6	23	3	1	1	3	0
		C5	2	3	1	1	1	3	0	1	2	4	3	3
	D2	C1	11	3	1	1	4	2	3	3	2	4	3	3
		C2	1	2	4	2	1	2	1	2	2	3	3	2
		C3	4	2	5	3	0	2	2	3	2	2	2	3
		C4	14	5	4	3	2	5	16	2	1	2	5	2
		C5	2	2	4	2	2	6	6	4	2	2	2	2

TABLE 55

COMPARISON OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: ROTE LEARNING VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	3,025.36		
B	2	21.32	10.66	–
D	1	4.23	4.23	–
C	4	57.87	14.47	1.14
BD	2	23.82	11.91	–
BC	8	128.65	16.08	1.26
DC	4	30.00	7.50	–
BDC	8	84.89	10.61	–
Error (b)	210	2,677.58	12.75	
Within Subjects	720	5,627.07		
A	3	51.20	17.07	2.16
BA	6	100.44	16.74	2.12
DA	3	1.92	0.64	–
CA	12	155.32	12.94	1.64
BDA	6	16.29	2.72	–
BCA	24	230.26	9.59	1.21
DCA	12	28.58	2.38	–
BDCA	24	64.63	2.69	–
Error (w)	630	4,978.43	7.90	
Total	959	8,652.43		

TABLE 56

SUMMARY OF THE RESULTS OF THE COMPARISONS OF THE GROUPS IN TERMS OF THE RESPONSE MEASURES RELATED TO THE ROTE LEARNING VERBAL TASK

			(2)	(3)	(4)	(5)	(6)
			χ^2				
Response Measure			Att.	No. R.	G. D. Ab.	G. D+	G. D-
Table			41	44	47	50	53
Comparison		B	N.S.	N.S.	.001	.001	.001
		D	N.S.	N.S.	N.S.	N.S.	N.S.
		C	N.S.	N.S.	.001	.001	.001
		A	.001	.001	.001	.001	.001
	B1	D	N.S.	N.S.	.001	.001	.001
		C	N.S.	N.S.	.001	.001	.001
		A	.001	.001	.001	.001	.001
	B2	D	N.S.	N.S.	.001	N.S.	.01
		C	N.S.	N.S.	.001	.001	.001
		A	.01	N.S.	.001	.001	.001
	B3	D	N.S.	N.S.	N.S.	.001	N.S.
		C	N.S.	N.S.	N.S.	N.S.	N.S.
		A	N.S.	.01	.001	N.S.	N.S.

(7)	(8)	(9)	(10)	(11)	(12)
	F				
Comparison	Att.	No. R.	G. D. Ab.	G. D+	G. D-
	43	46	49	52	55
B	.001[a]	.001[f]	N.S.	N.S.	N.S.
D	N.S.	N.S.	N.S.	N.S.	N.S.
C	N.S.	N.S.	N.S.	N.S.	N.S.
A	.001[b]	.001[g]	N.S.	N.S.	N.S.
BD	.01[c]	N.S.	N.S.	N.S.	N.S.
BC	N.S.	N.S.	N.S.	N.S.	N.S.
DC	N.S.	N.S.	N.S.	N.S.	N.S.
BDC	N.S.	N.S.	N.S.	N.S.	N.S.
BA	.001[d]	.01[h]	N.S.	N.S.	N.S.
DA	N.S.	N.S.	N.S.	N.S.	N.S.
CA	N.S.	N.S.	N.S.	N.S.	N.S.
BDA	.001[e]	.001[i]	N.S.	N.S.	N.S.
BCA	N.S.	N.S.	N.S.	N.S.	N.S.
DCA	N.S.	N.S.	N.S.	N.S.	N.S.
BDCA	N.S.	N.S.	N.S.	N.S.	N.S.

[a] B1>B2; B1>B3; B2=B3.

[b] A1>A2; A1>A3; A1>A4; A2>A3; A2>A4; A3>A4

[c] B1D1=B2D1; B1D1>B3D1; B2D1>B3D1; B1D2>B2D2; B1D2≥B3D2; B2D2=B3D2

[d] B1A1>B2A1; B1A1>B3A1; B2A1=B3A1; B1A2>B2A2; B1A2>B3A2; B2A2=B3A2; B1A3>B2A3; B1A3>B3A3; B2A3=B3A3; B1A4>B2A4; B1A4>B3A4; B2A4=B3A4

[e] B1D1A1=B2D1A1; B1D1A1>B3D1A1; B2D1A1=B3D1A1; B1D2A1>B2D2A1; B1D2A1=B3D2A1; B2D2A1=B3D2A1; B1D1A2=B2D1A2; B1D1A2>B3D1A2; B2D1A2=B3D1A2; B1D2A2>B2D2A2; B1D2A2>B3D2A2; B2D2A2=B3D2A2; B1D1A3=B2D1A3; B1D1A3>B3D1A3; B2D1A3=B3D1A3; B1D2A3>B2D2A3; B1D2A3>B3D2A3; B2D2A3=B3D2A3; B1D1A4=B2D1A4; B1D1A4=B3D1A4; B2D1A4=B3D1A4; B1D2A4>B2D2A4; B1D2A4>B3D2A4; B2D2A4=B3D2A4

[f] B1>B2; B1>B3; B2=B3

[g] A1>A2; A1>A3; A1>A4; A2>A3; A2>A4; A3>A4

[h] B1A1>B2A1; B1A1>B3A1; B2A1=B3A1; B1A2>B2A2; B1A2>B3A2; B2A2=B3A2; B1A3>B2A3; B1A3>B3A3; B2A3=B3A3; B1A4>B2A4; B1A4>B3A4; B2A4=B3A4.

[i] B1D1A1=B2D1A1; B1D1A1>B3D1A1; B2D1A1=B3D1A1; B1D2A1>B2D2A1; B1D2A1=B3D2A1; B2D2A1=B3D2A1; B1D1A2=B2D1A2; B1D1A2>B3D1A2; B2D1A2=B3D1A2; B1D2A2>B2D2A2; B1D2A2>B3D2A2; B2D2A2=B3D2A2; B1D1A3=B2D1A3; B1D1A3>B3D1A3; B2D1A3=B3D1A3; B1D2A3>B2D2A3; B1D2A3>B3D2A3; B2D2A3=B3D2A3; B1D1A4=B2D1A4; B1D1A4>B3D1A4; B2D1A4=B3D1A4; B1D2A4>B2D2A4; B1D2A4>B3D2A4; B2D2A4=B3D2A4.

TABLE 57

COMPARISON OF THE GROUPS IN TERMS OF DIRECTIONS OF GOAL CHANGE AFTER SUCCESS AND FAILURE: ROTE LEARNING VERBAL TASK (FREQUENCIES)

Comparison	Trial 9				Trial 10				Trial 17				Trial 18			
	Direction				Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	7	0	1	8	8	0	0	8	8	0	0	8	8	0	0	8
B1D1C2	6	1	1	8	8	0	0	8	7	1	0	8	7	1	0	8
B1D1C5	4	0	0	4	2	0	1	3	4	0	0	4	0	1	0	1
B1D2C1	6	1	1	8	6	1	1	8	8	0	0	8	7	1	0	8
B1D2C2	8	0	0	8	8	0	0	8	6	1	1	8	6	1	1	8
B1D2C5	5	1	2	8	3	0	2	5	1	1	1	3	4	1	0	5
B2D1C1	7	0	1	8	8	0	0	8	6	1	1	8	8	0	0	8
B2D1C2	5	0	3	8	6	0	2	8	7	1	0	8	7	0	1	8
B2D1C5	5	0	0	5	3	0	0	3	5	0	0	5	2	0	1	3
B2D2C1	7	0	1	8	6	1	1	8	7	0	1	8	7	0	1	8
B2D2C2	8	0	0	8	8	0	0	8	8	0	0	8	8	0	0	8
B2D2C5	3	0	1	4	3	0	2	5	3	0	2	5	1	3	2	6
B3D1C1	6	0	2	8	6	0	2	8	6	1	1	8	6	1	1	8
B3D1C2	8	0	0	8	7	0	1	8	5	1	2	8	6	0	2	8
B3D1C5	3	1	0	4	5	1	1	7	2	1	0	3	5	1	1	7
B3D2C1	4	1	3	8	7	0	1	8	5	1	2	8	7	0	1	8
B3D2C2	7	0	1	8	8	0	0	8	8	0	0	8	7	1	0	8
B3D2C5	2	0	0	2	5	0	1	6	4	0	1	5	2	1	0	3
	Trial 9				Trial 10				Trial 17				Trial 18			
	Direction				Direction				Direction				Direction			
	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T
B1D1C3	2	3	3	8	1	5	2	8	3	4	1	8	0	6	2	8
B1D1C4	0	7	1	8	0	5	3	8	0	5	3	8	0	6	2	8
B1D1C5	1	2	1	4	0	4	1	5	1	2	1	4	2	5	0	7
B1D2C3	1	6	1	8	1	7	0	8	1	6	1	8	3	5	0	8
B1D2C4	0	6	2	8	1	5	2	8	0	6	2	8	1	4	3	8
B1D2C5	0	0	0	0	0	3	0	3	0	4	1	5	0	2	1	3
B2D1C3	1	4	3	8	0	8	0	8	1	7	0	8	3	5	0	8
B2D1C4	0	7	1	8	0	7	1	8	1	6	1	8	0	7	1	8
B2D1C5	0	3	0	3	0	4	1	5	0	1	2	3	0	4	1	5
B2D2C3	0	6	2	8	1	6	1	8	1	3	4	8	1	4	3	8
B2D2C4	0	6	2	8	0	6	2	8	0	4	4	8	2	6	0	8
B2D2C5	0	4	0	4	0	3	0	3	0	3	0	3	0	2	0	2
B3D1C3	0	8	0	8	0	7	1	8	1	7	0	8	1	6	1	8
B3D1C4	1	6	1	8	2	4	2	8	1	6	1	8	2	5	1	8
B3D1C5	0	2	2	4	0	1	0	1	0	4	1	5	0	1	0	1
B3D2C3	0	8	0	8	0	6	2	8	0	7	1	8	1	5	2	8
B3D2C4	1	7	0	8	0	7	1	8	0	7	1	8	1	5	2	8
B3D2C5	1	4	1	6	1	1	0	2	1	1	1	3	0	3	2	5

TABLE 57--Continued

Comparison	Trial 11				Trial 14				Trial 15				Trial 19			
	Direction				Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	7	0	1	8	7	0	1	8	8	0	0	8	8	0	0	8
B1D1C2	5	1	2	8	6	1	1	8	8	0	0	8	7	0	1	8
B1D1C3	7	1	0	8	8	0	0	8	6	1	1	8	8	0	0	8
B1D1C5	4	1	0	5	5	0	0	5	2	0	0	2	3	0	1	4
B1D2C1	6	2	0	8	8	0	0	8	7	1	0	8	8	0	0	8
B1D2C2	6	2	0	8	7	0	1	8	5	1	2	8	6	1	1	8
B1D2C3	7	0	1	8	6	1	1	8	8	0	0	8	8	0	0	8
B1D2C5	1	3	1	5	5	0	2	7	4	1	2	7	3	1	0	4
B2D1C1	7	1	0	8	7	1	0	8	7	1	0	8	6	0	2	8
B2D1C2	7	0	1	8	4	2	2	8	8	0	0	8	5	2	1	8
B2D1C3	7	0	1	8	7	0	1	8	7	1	0	8	7	1	0	8
B2D1C5	3	0	0	3	3	1	1	5	1	0	1	2	6	0	0	6
B2D2C1	5	1	2	8	4	0	4	8	6	0	2	8	7	0	1	8
B2D2C2	7	0	1	8	7	1	0	8	8	0	0	8	8	0	0	8
B2D2C3	6	1	1	8	8	0	0	8	6	1	1	8	6	2	0	8
B2D2C5	6	0	1	7	5	0	1	6	4	1	1	6	4	0	1	5
B3D1C1	6	0	2	8	7	1	0	8	7	0	1	8	6	1	1	8
B3D1C2	7	1	0	8	7	0	1	8	8	0	0	8	7	0	1	8
B3D1C3	6	0	2	8	5	1	2	8	5	0	3	8	6	1	1	8
B3D1C5	4	0	2	6	4	1	1	6	1	1	1	3	3	1	0	4
B3D2C1	7	1	0	8	7	0	1	8	7	1	0	8	5	2	1	8
B3D2C2	8	0	0	8	7	0	1	8	7	1	0	8	7	0	1	8
B3D2C3	7	0	1	8	5	1	2	8	6	0	2	8	8	0	0	8
B3D2C5	4	1	0	5	5	2	0	7	5	0	1	6	3	0	1	4
	Trial 12				Trial 13				Trial 16				Trial 20			
	Direction				Direction				Direction				Direction			
	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T
B1D1C2	0	5	3	8	2	5	1	8	1	6	1	8	1	6	1	8
B1D1C3	1	6	1	8	0	6	2	8	2	6	0	8	0	7	1	8
B1D1C4	0	6	2	8	0	5	3	8	1	6	1	8	1	6	1	8
B1D1C5	1	2	0	3	1	1	1	3	0	4	1	5	0	1	3	4
B1D2C2	1	5	2	8	0	6	2	8	2	3	3	6	0	5	3	8
B1D2C3	1	7	0	8	1	7	0	8	0	7	1	8	2	6	0	8
B1D2C4	0	6	2	8	0	5	3	8	2	4	2	8	2	5	1	8
B1D2C5	0	1	0	1	0	2	0	2	0	0	2	2	0	3	1	4
B2D1C2	0	5	3	8	0	7	1	8	1	5	2	8	2	5	1	8
B2D1C3	0	8	0	8	0	8	0	8	0	8	0	8	1	7	0	8
B2D1C4	1	5	2	8	0	6	2	8	0	7	1	8	0	5	3	8
B2D1C5	1	1	1	3	1	2	2	5	0	1	2	3	0	4	1	5
B2D2C2	0	6	2	8	0	8	0	8	0	8	0	8	0	7	1	8
B2D2C3	0	6	2	8	2	4	2	8	0	6	2	8	1	6	1	8
B2D2C4	0	7	1	8	1	6	1	8	1	6	1	8	1	6	1	8
B2D2C5	0	3	0	3	0	1	0	1	0	3	0	3	0	3	1	4
B3D1C2	0	7	1	8	2	6	0	8	1	6	1	8	0	6	2	8
B3D1C3	0	6	2	8	0	8	0	8	1	4	3	8	0	7	1	8
B3D1C4	1	5	2	8	2	6	0	8	1	6	1	8	2	6	0	8
B3D1C5	0	1	1	2	0	1	1	2	1	0	1	2	0	0	1	1
B3D2C2	0	7	1	8	0	8	0	8	1	7	0	8	1	5	2	8
B3D2C3	0	7	1	8	2	6	0	8	0	5	3	8	1	7	0	8
B3D2C4	0	5	3	8	1	5	2	8	2	5	1	8	1	6	1	8
B3D2C5	0	0	0	0	1	2	1	4	0	3	1	4	0	2	0	2

TABLE 57--Continued

Comparison	Trial 21				Trial 22				Trial 23			
	Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	8	0	0	8	8	0	0	8	8	0	0	8
B1D1C2	7	1	0	8	6	1	1	8	7	1	0	8
B1D1C3	7	0	1	8	6	1	1	8	6	1	1	8
B1D1C4	8	0	0	8	8	0	0	8	8	0	0	8
B1D1C5	2	1	1	4	0	1	1	2	3	1	1	5
B1D2C1	7	1	0	8	8	0	0	8	7	1	0	8
B1D2C2	6	1	1	8	6	1	1	8	5	2	1	8
B1D2C3	6	1	1	8	7	1	0	8	7	1	0	8
B1D2C4	5	2	1	8	7	1	0	8	6	1	1	8
B1D2C5	4	0	1	5	3	1	0	4	4	3	0	7
B2D1C1	7	1	0	8	7	1	0	8	7	1	0	8
B2D1C2	7	1	0	8	6	0	2	8	6	0	2	8
B2D1C3	7	1	0	8	7	0	1	8	7	1	0	8
B2D1C4	6	0	2	8	7	0	1	8	7	0	1	8
B2D1C5	5	1	1	7	4	1	2	7	4	0	1	5
B2D2C1	6	1	1	8	8	0	0	8	6	1	1	8
B2D2C2	8	0	0	8	8	0	0	8	7	1	0	8
B2D2C3	7	0	1	8	6	1	1	8	8	0	0	8
B2D2C4	6	0	2	8	6	1	1	8	7	0	1	8
B2D2C5	2	0	2	4	4	1	3	8	3	0	3	6
B3D1C1	7	0	1	8	6	0	2	8	7	0	1	8
B3D1C2	6	0	2	8	7	0	1	8	7	0	1	8
B3D1C3	4	2	2	8	5	0	3	8	6	0	2	8
B3D1C4	8	0	0	8	8	0	0	8	8	0	0	8
B3D1C5	2	1	1	4	2	1	1	4	2	2	1	5
B3D2C1	7	1	0	8	8	0	0	8	6	1	1	8
B3D2C2	8	0	0	8	7	1	0	8	7	1	0	8
B3D2C3	5	1	2	8	5	1	2	8	6	1	1	8
B3D2C4	8	0	0	8	8	0	0	8	8	0	0	8
B3D2C5	3	0	1	4	6	0	1	7	3	2	1	6

TABLE 58

COMPARISON OF THE GROUPS IN TERMS OF ATTAINMENT TIME: ROTE LEARNING NON-VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
						B1			B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	383	694	30.622^{***}							
	B2		383	565								
	B3		383	984								
D	D1	1	575	721	9.112^{**}	191	808	7.153	443	7.280^{**}	795	6.694^{**}
	D2		575	928		191	548		656		1,158	
C	C1	5	191	783	15.556^{**}	63	604	49.942^{***}	484	17.043^{***}	974	6.225
	C2		191	699		63	411		509		1,026	
	C3		191	821		63	359		525		1,214	
	C4		191	671		63	684		312		749	
	C5		191	813		63	410		871		792	
	C6		191	1,106		63	1,495		585		1,188	
A	A1	3	287	921	26.817^{***}	95	1,097	69.306^{***}	652	17.841^{***}	866	1.095
	A2		287	560		95	370		303		837	
	A3		287	540		95	252		327		790	
	A4		287	690		95	313		432		972	

$^{**}p < .01$

$^{***}p < .001$

observable among the scores of subjects in the two orientation groups while such heterogeneity did exist among the scores of the subjects in the six type-frequency groups; also, there was extreme heterogeneity of score variance in the four sections of trials. On the other hand, within the superior group, the scores of the subjects receiving the two orientations were heterogeneous in terms of variability but the scores of the subjects receiving the six different type-frequency sets of information were homogeneous as were the subjects' scores in the four sections of trials.

Data pertinent to the mean attainment times on the RLN appear in Tables 59 and 60 and Column 7 of Table 70. A difference did exist among the means of the four sections of trials. These differences were located as follows: the mean of the first section of trials was larger than those of the second, the third, and the fourth sections; the mean of the second section exceeded that of the third section; the means of the second and fourth sections and of the third and fourth sections did not differ.

There were differences also among the means of the intelligence groups: the mean of the retarded group was smaller than those of the normal and superior groups and the mean of the normal group was smaller than that of the superior group. Further, there were differences among the means of the cells formed by the overlap of levels and trials. These relationships were revealed by subsequent scrutiny. On the first section of trials, the mean of the retarded group did not differ from that of the normal group, and both of these means were smaller than that of the superior group. On the second section of trials, the mean of the retarded group was smaller than those of the normal and superior groups; the latter two means were equivalent. On the third section of trials, the mean of the retarded group was smaller than those of the normal and superior groups while the mean of the normal group was smaller than that of the superior group. On the fourth section of trials, the relationships were the same as those which occurred on the third section.

There were no differences among the subjects' mean scores when they were categorized according to the orientation or type-frequency conditions. There were differences among the means of the subjects in the groups defined by the overlap of levels and orientation. Subsequent analyses suggested these relationships. Within the individual orientation, the mean of the retarded group equalled the mean of the normal group, and the means of the retarded and normal groups both were smaller than the mean of the superior group. Within the group orientation, the mean of the retarded group was smaller than those of the normal and superior groups and the mean of the normal group was smaller than that of the superior group. No differences were present among the means compared in any of the remaining analyses.

Level of Aspiration Responses

Absolute Goal Discrepancy Scores

Included in Table 61 and summarized in Column 3 of Table 70 are the data related to the variability of the subjects' absolute

TABLE 59

DESCRIPTION OF THE GROUPS IN TERMS OF ATTAINMENT TIME: ROTE LEARNING NON-VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	96	75	69	71	100	83	81	76	124	99	91	95
		C2	95	79	67	68	106	84	75	78	108	84	72	78
		C3	82	63	59	59	95	71	68	68	104	84	76	84
		C4	112	81	71	68	91	70	66	63	113	91	81	83
		C5	85	71	62	64	92	74	68	72	110	89	87	93
		C6	139	96	75	79	105	84	76	77	110	88	86	98
	D2	C1	98	74	57	58	109	84	72	71	114	93	87	91
		C2	93	70	63	60	101	77	75	75	119	97	91	92
		C3	90	70	57	56	112	89	80	82	122	103	91	92
		C4	98	69	57	56	96	79	69	67	120	95	92	95
		C5	79	66	60	56	130	93	84	91	115	94	83	84
		C6	96	77	66	62	112	92	88	94	118	100	98	96

TABLE 60

COMPARISON OF THE GROUPS IN TERMS OF ATTAINMENT TIME: ROTE LEARNING NON-VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	287	82,851.56		
B	2	11,263.96	5,631.98	22.32***
D	1	160.28	160.28	–
C	5	1,817.78	363.56	1.44
BD	2	1,976.63	988.32	3.92***
BC	10	1,668.75	166.88	–
DC	5	843.54	168.71	–
BDC	10	1,537.27	153.73	–
Error (b)	252	63,583.35	252.31	
Within Subjects	864	35,778.46		
A	3	21,381.49	7,127.16	442.41***
BA	6	333.46	55.58	3.45**
DA	3	47.46	15.82	–
CA	15	112.22	7.48	–
BDA	6	81.27	13.55	–
BCA	30	737.69	24.59	1.53
DCA	15	418.23	27.88	1.73
BDCA	30	489.50	16.32	1.01
Error (w)	756	12,177.14	16.11	
Total	1,151	118,630.02		

TABLE 60--Continued

B. INDIVIDUAL COMPARISONS

Comparison							
B	$\bar{X}$	B1:74.46	B2:84.27	B3:93.96			
	Group	B1 < B2	B1 < B3	B2 < B3			
	Diff.	9.79	19.50	9.69			
	t	5.439^{***}	9.330^{***}	4.821^{***}			
BD	$\bar{X}$	B1D1:78.58	B2D1:80.12	B3D1:92.83			
	Group	B1D1 = B2D1	B1D1 < B3D1	B2D1 < B3D1			
	Diff.	1.54	14.25	12.71			
	t	0.602	4.920^{***}	4.994^{***}			
	$\bar{X}$	B1D2:70.33	B2D2:88.41	B3D2:99.25			
	Group	B1D2 < B2D2	B1D2 < B3D2	B2D2 < B3D2			
	Diff.	18.08	28.92	10.88			
	t	7.201^{***}	9.678^{***}	3.530^{***}			
A	$\bar{X}$	A1:105.25	A2:80.22	A3:75.00	A4:76.44		
	Group	A1 > A2	A1 > A3	A1 > A4	A2 > A3	A2 = A4	A3 = A4
	Diff.	25.03	30.25	28.81	5.22	3.78	1.44
	t	11.026^{***}	13.444^{***}	12.156^{***}	2.677^{**}	1.817	0.696
BA	$\bar{X}$	B1A1:96.91	B2A1:104.08	B3A1:114.75	B1A2:74.25		
	Group	B1A1 = B2A1	B1A1 < B3A1	B2A1 < B3A1	B1A2 < B2A2		
	Diff.	7.17	17.84	10.67	7.42		
	t	1.680	3.946^{***}	2.683^{**}	2.803^{**}		
	$\bar{X}$	B2A2:81.67	B3A2:84.75	B1A3:63.58	B2A3:75.17		
	Group	B1A2 < B3A2	B2A2 = B3A2	B1A3 < B2A3	B1A3 < B3A3		
	Diff.	10.50	3.08	11.59	22.67		
	t	2.961^{**}	0.893	4.719^{***}	6.881^{***}		
	$\bar{X}$	B3A3:86.25	B1A4:63.08	B2A4:76.17	B3A4:90.08		
	Group	B2A3 < B3A3	B1A4 < B2A4	B1A4 < B3A4	B2A4 < B3A4		
	Diff.	11.08	13.09	27.00	13.91		
	t	3.240^{**}	4.594^{***}	7.383^{***}	3.638^{***}		

$^{**}p < .01$

$^{***}p < .001$

TABLE 61

COMPARISON OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: ROTE LEARNING NON-VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group		Between Groups			Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	319	154	35.556^{***}							
	B2		319	155								
	B3		319	85								
D	D1	1	479	159	20.685^{***}	159	176	3.104	174	2.167	127	44.737^{***}
	D2		479	104		159	133		137		43	
C	C1	4	191	75	185.847^{***}	63	13	227.903^{***}	171	17.863^{**}	42	74.821^{***}
	C2		191	41		63	24		70		29	
	C3		191	124		63	140		178		55	
	C4		191	124		63	84		189		100	
	C5		191	276		63	461		156		198	
A	A1	3	239	307	285.515^{***}	79	372	126.545^{***}	304	85.617^{***}	250	276.202^{***}
	A2		239	59		79	129		37		8	
	A3		239	95		79	64		173		48	
	A4		239	45		79	32		90		12	

$^{**}p < .01$

$^{***}p < .001$

goal discrepancy scores for the RLN. The results of the over-all analyses indicate that extreme heterogeneity of variance occurred when the subjects' scores were categorized according to level, orientation, type-frequency, and sections of trials. The results of the analyses of the scores within the superior group were consistent. Within both the retarded and normal groups, there was homogeneity of variance among the scores of the subjects who received the two orientations. On the other hand, heterogeneity of variance was apparent when the scores were classified according to type-frequency and trials.

Tables 62 and 63 contain evidence pertinent to the subjects' mean absolute goal discrepancy scores for the RLN. The probability levels of the results of the statistical tests appear in Column 8 of Table 70. No differences existed among the mean absolute goal discrepancy scores of the levels groups, the orientation groups, or any subgroup formed by a combination of the levels, treatments, and/or trials. Two significant F ratios did occur; these were related to sections of trials and the type-frequency condition. The relationships apparent among the means of the four sections of trials were these: the mean of the first section was larger than those of the second, third, and fourth sections; no differences occurred among the latter means.

Subsequent scrutiny of the means of the type-frequency groups revealed that in only one case was there a difference between two groups. These groups were the C2 (33 percent success; 66 percent failure) and the C5 (level of aspiration control) groups; the C2 group had the lower mean absolute goal discrepancy score.

Positive Goal Discrepancy Scores

In Table 64 and Column 4 of Table 70 are the statistics which reflect variability of the subjects' positive goal discrepancy scores related to the RLN performance. There was marked heterogeneity of variance in the scores of the total group of subjects when they were categorized according to levels, treatments, and trials. Consistent relationships were apparent within the superior group but not within the retarded and normal groups. Within these latter groups, homogeneity existed in the scores of the two groups of subjects who received the different orientations while heterogeneity existed in the scores of the subjects in the six type-frequency groups and the subjects' scores in the four sections of trials.

In Tables 65 and 66 and Column 9 of Table 70 is the evidence about the relationships among the subjects' mean positive goal discrepancy scores for the RLN. There were no mean differences apparent when the scores were classified according to level or orientation. With one exception, the same statement can be made about the groups defined by the combination of levels, treatments, and trials. The one exception was the response of the subjects in the type-frequency groups as they reacted to the several sections of trials.

TABLE 62

DESCRIPTION OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: ROTE LEARNING NON-VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	4	4	4	5	20	4	3	2	10	4	4	5
		C2	6	4	5	3	4	4	4	5	10	5	5	5
		C3	4	6	5	6	9	4	4	2	7	3	4	3
		C4	16	8	9	8	14	13	19	16	10	5	12	3
		C5	30	20	9	8	16	6	4	6	20	5	4	7
	D2	C1	6	3	4	4	7	4	4	3	6	4	5	4
		C2	8	5	3	5	14	4	3	6	6	3	3	4
		C3	16	12	11	7	8	5	17	5	18	4	4	6
		C4	6	9	10	2	5	4	7	4	11	6	8	5
		C5	21	8	7	5	20	11	9	9	6	6	4	4

TABLE 63

COMPARISON OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: ROTE LEARNING NON-VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	5,811.85		
B	2	70.65	35.33	1.64
D	1	9.84	9.84	-
C	4	479.14	119.79	5.57***
BD	2	0.30	0.15	-
BC	8	161.42	20.18	-
DC	4	298.60	74.65	3.47
BDC	8	271.77	33.97	1.58
Error (b)	210	4,520.13	21.52	
Within Subjects	720	9,945.78		
A	3	661.07	220.36	16.76***
BA	6	26.40	4.40	-
DA	3	11.52	3.84	-
CA	12	326.35	27.20	2.07
BDA	6	14.26	2.38	-
BCA	24	233.96	9.75	-
DCA	12	112.55	9.38	-
BDCA	24	275.19	11.47	-
Error (w)	630	8,284.48	13.15	
Total	959	15,757.63		

TABLE 63--*Continued*

B. INDIVIDUAL COMPARISONS						
Comparison	$\bar{X}$	C1:3.43	C2:3.40	C3:4.67	C4:5.80	C5:6.80
C	Group	C1 = C2	C1 = C3	C1 = C4	C1 = C5	C2 = C3
	Diff.	0.03	1.24	2.37	3.37	1.27
	t	0.039	1.216	2.324	2.478	1.366
	Group	C2 = C4	C2 < C5	C3 = C4	C3 = C5	C4 = C5
	Diff.	2.40	3.40	1.13	2.13	1.00
	t	2.581	2.636^{**}	0.991	1.469	0.690
A	$\bar{X}$	A1:11.22	A2:6.08	A3:6.44	A4:5.19	
	Group	A1 > A2	A1 > A3	A1 > A4	A2 = A3	
	Diff.	5.14	4.78	6.03	0.36	
	t	4.145^{***}	3.677^{***}	4.983^{***}	0.444	
	Group	A2 = A4	A3 = A4			
	Diff.	0.89	1.25			
	t	1.348	1.623			

$^{**}p < .01$

$^{***}p < .001$

TABLE 64

COMPARISON OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: ROTE LEARNING NON-VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	319	134	31.119***							
	B2		319	86								
	B3		319	75								
D	D1	1	479	120	21.988***	159	157	4.715	85	0.028	116	57.622***
	D2		479	78		159	111		87		33	
C	C1	4	191	34	276.944***	63	15	200.518***	44	39.051***	45	84.784***
	C2		191	43		63	26		71		33	
	C3		191	68		63	96		45		63	
	C4		191	74		63	94		91		33	
	C5		191	262		63	410		164		202	
A	A1	3	239	279	567.551***	79	378	166.784***	217	137.419***	247	385.190***
	A2		239	29		79	45		32		9	
	A3		239	38		79	53		50		11	
	A4		239	21		79	36		20		7	

***$p < .001$

TABLE 65

DESCRIPTION OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: ROTE LEARNING NON-VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	3	4	4	4	7	4	2	2	10	3	2	3
		C2	6	4	5	2	4	3	3	2	10	4	4	1
		C3	4	5	6	7	8	5	5	1	5	3	5	2
		C4	16	4	7	8	11	10	14	1	9	4	5	1
		C5	30	9	10	4	16	6	4	7	18	5	3	4
	D2	C1	6	3	4	4	7	4	5	3	5	4	5	3
		C2	8	5	3	4	14	5	2	3	4	3	2	1
		C3	12	6	4	1	8	2	2	1	18	4	2	1
		C4	6	7	7	1	4	4	5	0	4	4	3	0
		C5	20	8	7	4	18	6	8	9	5	4	2	2

TABLE 66

COMPARISON OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: ROTE LEARNING NON-VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	3,827.96		
B	2	84.75	42.38	2.91
D	1	14.78	14.78	1.01
C	4	352.26	88.07	6.04***
BD	2	6.18	3.09	-
BC	8	130.79	16.35	1.12
DC	4	83.40	20.85	1.43
BDC	8	96.30	12.04	-
Error (b)	210	3,059.50	14.57	
Within Subjects	720	8,007.03		
A	3	845.77	281.92	28.19***
BA	6	2.34	0.39	-
DA	3	5.15	1.72	-
CA	12	304.70	25.39	2.54**
BDA	6	27.81	4.64	-
BCA	24	184.91	7.70	-
DCA	12	170.54	14.21	1.42
BDCA	24	163.21	6.80	-
Error (w)	630	6,302.60	10.00	
Total	959	11,834.99		

TABLE 66--Continued

B. INDIVIDUAL COMPARISONS

Comparison						
C	$\overline{X}$	C1:2.77	C2:2.83	C3:3.15	C4:3.72	C5:5.85
	Group	C1 = C2	C1 = C3	C1 < C4	C1 = C5	C2 = C3
	Diff.	0.05	0.38	0.95	3.08	0.32
	t	0.078	1.310	2.969**	2.484	0.914
	Group	C2 = C4	C2 = C5	C3 = C4	C3 = C5	C4 = C5
	Diff.	0.89	3.02	0.57	2.70	2.13
	t	2.342	2.397	1.018	2.045	1.601
A	$\overline{X}$	A1:9.90	A2:4.67	A3:4.64	A4:2.78	
	Group	A1 > A2	A1 > A3	A1 > A4	A2 = A3	
	Diff.	5.23	5.26	7.12	0.03	
	t	4.628***	4.574***	6.357***	0.057	
	Group	A2 > A4	A3 > A4			
	Diff.	1.89	1.89			
	t	4.109***	3.780***			
CA	$\overline{X}$	C1A1:6.38	C2A1:7.60	C3A1:9.02	C4A1:8.40	
	Group	C1A1 = C2A1	C1A1 = C3A1	C1A1 = C4A1	C1A1 = C5A1	
	Diff.	1.22	2.65	2.02	11.71	
	t	0.548	1.075	0.984	2.684	
	$\overline{X}$	C5A1:18.08	C1A2:3.65	C2A2:4.04	C3A2:3.98	
	Group	C2A1 = C3A1	C2A1 = C4A1	C2A1 = C5A1	C3A1 = C4A1	
	Diff.	1.42	0.79	10.48	0.63	
	t	0.549	0.361	2.365	0.258	
	$\overline{X}$	C4A2:5.46	C5A2:6.21	C1A3:3.58	C2A3:3.15	
	Group	C3A1 = C5A1	C4A1 = C5A1	C1A2 = C2A2	C1A2 = C3A2	
	Diff.	9.06	9.68	0.39	0.33	
	t	1.996	2.233	0.708	0.429	

TABLE 66--Continued

Comparison	$\overline{X}$	C3A3:3.94	C4A3:6.77	C5A3:5.73	C1A4:2.98
CA	Group	C1A2 = C4A2	C1A2 = C5A2	C2A2 = C3A2	C2A2 = C4A2
	Diff.	1.81	2.56	0.06	1.42
	t	1.505	2.433	0.084	1.189
	$\overline{X}$	C2A4:2.19	C3A4:1.96	C4A4:1.71	C5A4:5.04
	Group	C2A2 = C5A2	C3A2 = C4A2	C3A2 = C5A2	C4A2 = C5A2
	Diff.	2.17	1.48	2.23	0.75
	t	2.095	1.135	1.912	0.505
	Group	C1A3 = C2A3	C1A3 = C3A3	C1A3 = C4A3	C1A3 = C5A3
	Diff.	0.44	0.36	3.19	2.15
	t	0.755	0.433	2.211	1.771
	Group	C2A3 = C3A3	C2A3 = C4A3	C2A3 = C5A3	C3A3 = C4A3
	Diff.	0.79	3.62	2.58	2.83
	t	1.076	2.604	2.232	1.877
	Group	C3A3 = C5A3	C4A3 = C5A3	C1A4 = C2A4	C1A4 = C3A4
	Diff.	1.79	1.04	0.79	1.02
	t	1.382	0.594	1.343	1.336
	Group	C1A4 = C4A4	C1A4 = C5A4	C2A4 = C3A4	C2A4 = C4A4
	Diff.	1.27	2.06	0.23	0.48
	t	1.474	2.223	0.284	0.532
	Group	C2A4 < C5A4	C3A4 = C4A4	C3A4 < C5A4	C4A4 < C5A4
	Diff.	2.85	0.25	3.08	3.33
	t	2.958***	0.244	2.853**	2.892**

** $p < .01$

*** $p < .001$

There was a difference among the means of the scores in the several sections of trials. The mean of the first section was larger than those in the second, third, and fourth sections; the mean of the second section was equivalent to that in the third section and larger than that in the fourth section; the mean of the third section was larger than that of the fourth section. That is, with the exception of the null relationship between the means of the second and third sections, the means of every other pair of sections differed with the preceding means being the larger.

The F-ratio associated with the type-frequency factor also was significant. Further analyses indicated that a difference existed in only one comparison, C1 (100 percent success) and C4 (100 percent failure). Here, the C1 group had the smaller mean positive goal discrepancy score.

It was noted above that the F-ratio related to the CA interaction was significant. Subsequent scrutiny revealed these relationships to be extant. On the fourth section of trials, the means of the C2 (66 percent success, 33 percent failure) group, the C3 (33 percent success, 66 percent failure) group, and the C4 (100 percent failure) group, each were lower than the mean of the C5 (level of aspiration control) group. In all other comparisons, in all sections of trials, null relationships obtained.

Negative Goal Discrepancy Scores

Information pertinent to the relationship between the variances of the subjects' negative goal discrepancy scores for the RLN is contained in Tables 67 and Column 5 of Table 70. Over the total group of subjects, there was extreme heterogeneity in the variability of the scores when they were classified according to level, orientation, type-frequency, and trials. This was also the case within the retarded group and within the normal group. Within the superior group, equivalent variability occurred in the scores in the orientation groups but heterogeneity existed in the variability of the scores in the type-frequency and trials categories.

Tables 68 and 69 and Column 10 of Table 70 consist of data which reflect the central tendencies in the subjects' negative goal discrepancy scores for the RLN. Therein, it may be seen that the probability of the F-ratio yielded by the analyses of the differences among the mean scores of the subjects in the six type-frequency groups is less than .01 but greater than .001. The related chi square has a probability of less than .001 indicating that extreme heterogeneity of variance was present in the scores involved. Hence, the F-ratio cannot be regarded as significant.

On the other hand, there was evidence that differences did occur among the means of the scores in the several sections of trials. More discrete analyses indicated that the mean of the first section was smaller than those of the succeeding sections, the mean of the second section was equivalent to those of the

TABLE 67

COMPARISON OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: ROTE LEARNING NON-VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
						B1			B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	319	99	146.555^{***}							
	B2		319	112								
	B3		319	29								
D	D1	1	479	101	33.305^{***}	159	127	13.609^{***}	143	12.391^{***}	32	1.355
	D2		479	59		159	71		81		27	
C	C1	4	191	53	219.173^{***}	63	7	203.448^{***}	147	140.723^{***}	6	167.291^{***}
	C2		191	14		63	21		13		9	
	C3		191	92		63	103		160		12	
	C4		191	127		63	84		202		94	
	C5		191	104		63	267		27		19	
A	A1	3	239	54	32.701^{***}	79	9	128.392^{***}	123	40.512^{***}	29	49.177^{***}
	A2		239	70		79	150		43		12	
	A3		239	111		79	92		187		54	
	A4		239	79		79	131		91		18	

$^{***}p < .001$

TABLE 68

DESCRIPTION OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: ROTE LEARNING NON-VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	1	1	2	1	12	1	1	1	0	2	2	2
		C2	0	2	2	2	0	3	3	4	0	3	4	4
		C3	0	4	4	4	1	2	2	3	2	2	4	2
		C4	1	8	10	4	2	13	18	16	1	4	10	4
		C5	0	18	6	13	0	5	2	3	1	3	3	5
	D2	C1	0	3	1	1	0	1	2	1	0	1	2	1
		C2	0	6	2	1	0	2	2	6	1	3	3	3
		C3	4	10	13	7	1	4	17	4	0	4	5	6
		C4	0	7	10	2	1	1	7	4	7	4	7	6
		C5	0	1	2	1	1	8	5	2	1	4	3	3

TABLE 69

COMPARISON OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: ROTE LEARNING NON-VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	4,413.08		
B	2	20.08	10.04	-
D	1	9.54	9.54	-
C	4	278.52	69.63	4.05^{**}
BD	2	9.82	4.91	-
BC	8	79.93	9.99	-
DC	4	163.07	40.76	2.37
BDC	8	241.54	30.19	1.76
Error (b)	210	3,610.58	17.19	
Within Subjects	720	5,185.53		
A	3	240.52	80.17	12.00^{***}
BA	6	53.57	8.93	1.34
DA	3	13.74	4.58	-
CA	12	233.24	19.44	2.91^{**}
BDA	6	30.64	5.11	-
BCA	24	130.99	5.46	-
DCA	12	122.47	10.21	1.53
BDCA	24	155.01	6.46	-
Error (w)	630	4,205.35	6.68	
Total	959	9,598.61		

TABLE 69--*Continued*

B. INDIVIDUAL COMPARISONS

Comparison	$\overline{X}$	A1:1.32	A2:4.42	A3:5.06	A4:3.84
A	Group	A1 < A2	A1 < A3	A1 < A4	A2 = A3
	Diff.	3.10	3.74	2.52	0.64
	t	13.478***	14.385***	10.500***	2.370
	Group	A2 = A4	A3 > A4		
	Diff.	0.58	1.22		
	t	2.320	4.357***		
CA	$\overline{X}$	C1A1:2.42	C2A1:0.27	C3A1:1.31	C4A1:1.96
	Group	C1A1 = C2A1	C1A1 = C3A1	C1A1 = C4A1	C1A1 = C5A1
	Diff.	2.15	1.10	0.46	1.77
	t	1.057	0.571	0.202	0.865
	$\overline{X}$	C5A1:0.65	C1A2:1.69	C2A2:3.52	C3A2:4.33
	Group	C2A1 = C3A1	C2A1 = C4A1	C2A1 = C5A1	C3A1 = C4A1
	Diff.	1.04	1.69	0.38	0.64
	t	1.691	1.609	0.971	0.545
	$\overline{X}$	C4A2:5.94	C5A2:6.58	C1A3:1.52	C2A3:2.65
	Group	C3A1 = C5A1	C4A1 = C5A1	C1A2 = C2A2	C1A2 = C3A2
	Diff.	0.67	1.31	1.83	2.64
	t	0.992	1.213	2.238	2.175
	$\overline{X}$	C3A3:7.58	C4A3:10.10	C5A3:3.42	C1A4:0.98
	Group	C1A2 < C4A2	C1A2 = C5A2	C2A2 = C3A2	C2A2 = C4A2
	Diff.	4.25	4.90	0.81	2.42
	t	3.169**	2.587	0.600	1.648
	$\overline{X}$	C2A4:3.23	C3A4:4.38	C4A4:5.98	C5A4:4.60
	Group	C2A2 = C5A2	C3A2 = C4A2	C3A2 = C5A2	C4A2 = C5A2
	Diff.	3.06	1.61	2.25	0.64
	t	1.544	0.933	1.033	0.286

TABLE 69--Continued

Comparison	Group	C1A3 = C2A3	C1A3 = C3A3	C1A3 < C4A3	C1A3 = C5A3
	Diff.	1.12	6.06	8.58	1.90
	t	2.098	2.574	4.007***	2.421
	Group	C2A3 = C3A3	C2A3 < C4A3	C2A3 = C5A3	C3A3 = C4A3
	Diff.	4.94	7.46	0.77	2.52
	t	2.098	3.489***	0.998	0.803
	Group	C3A3 = C5A3	C4A3 > C5A3	C1A4 < C2A4	C1A4 < C3A4
CA	Diff.	4.17	6.69	2.25	3.40
	t	1.721	3.021**	3.279**	5.208***
	Group	C1A4 < C4A4	C1A4 = C5A4	C2A4 = C3A4	C2A4 = C4A4
	Diff.	5.00	3.62	1.15	2.75
	t	2.906**	1.705	1.346	1.523
	Group	C2A4 = C5A4	C3A4 = C4A4	C3A4 = C5A4	C4A4 = C5A4
	Diff.	1.38	1.60	0.23	1.38
	t	0.626	0.895	0.104	0.508

** $p < .01$

*** $p < .001$

TABLE 70

SUMMARY OF THE RESULTS OF THE COMPARISONS OF THE GROUPS IN TERMS OF THE RESPONSE MEASURES RELATED TO THE ROTE LEARNING NON-VERBAL TASK

(1)			(2)	(3)	(4)	(5)
			χ^2			
Response Measure			Att.	G.D. Ab.	G.D+	G.D-
Table			58	61	64	67
Comparison		B	.001	.001	.001	.001
		D	.01	.001	.001	.001
		C	.01	.001	.001	.001
		A	.001	.001	.001	.001
	B1	D	N.S.	N.S.	N.S.	.001
		C	.001	.001	.001	.001
		A	.001	.001	.001	.001
	B2	D	.01	N.S.	N.S.	.001
		C	.01	.01	.001	.001
		A	.001	.001	.001	.001
	B3	D	.01	.001	.001	N.S.
		C	N.S.	.001	.001	.001
		A	N.S.	.001	.001	.001

(6)	(7)	(8)	(9)	(10)
	F			
Comparison	Att.	G.D. Ab.	G.D+	G.D-
	60	63	66	69
B	.001[a]	N.S.	N.S.	N.S.
D	N.S.	N.S.	N.S.	N.S.
C	N.S.	.001[e]	.001[g]	.01[j]
A	.001[b]	.001[f]	.001[h]	.001[k]
BD	.001[c]	N.S.	N.S.	N.S.
BC	N.S.	N.S.	N.S.	N.S.
DC	N.S.	N.S.	N.S.	N.S.
BDC	N.S.	N.S.	N.S.	N.S.
BA	.01[d]	N.S.	N.S.	N.S.
DA	N.S.	N.S.	N.S.	N.S.
CA	N.S.	N.S.	.01[i]	.01[l]
BDA	N.S.	N.S.	N.S.	N.S.
BCA	N.S.	N.S.	N.S.	N.S.
DCA	N.S.	N.S.	N.S.	N.S.
BDCA	N.S.	N.S.	N.S.	N.S.

[a] B1<B2; B1<B3; B2<B3

[b] A1>A2; A1>A3; A1>A4; A2>A3; A2=A4; A3=A4

[c] B1D1=B2D1; B1D1<B3D1; B2D1<B3D1; B1D2<B2D2; B1D2<B3D2; B2D2<B3D2

[d] B1A1=B2A1; B1A1<B3A1; B2A1<B3A1; B1A2<B2A2; B1A2<B3A2; B2A2=B3A2; B1A3<B2A3; B1A3<B3A3; B2A3<B3A3; B1A4<B2A4; B1A4<B3A4; B2A4<B3A4

[e] C1=C2; C1=C3; C1=C4; C1=C5 C2=C3; C2=C4; C2<C5; C3=C4; C3=C5;C4=C5

[f] A1>A2; A1>A3; A1>A4; A2=A3; A2=A4; A3=A4

[g] C1=C2; C1=C3; C1<C4; C1=C5; C2=C3; C2=C4; C2=C5; C3=C4; C3=C5;C4=C5

[h] A1>A2; A1>A3; A1>A4; A2=A3; A2>A4; A3>A4

[i] C1A1=C2A1; C1A1=C3A1; C1A1=C4A1; C1A1=C5A1; C2A1=C3A1; C2A1=C4A1; C2A1=C5A1; C3A1=C4A1; C3A1=C5A1; C4A1=C5A1; C1A2=C2A2; C1A2=C3A2; C1A2=C4A2; C1A2=C5A2; C2A2=C3A2; C2A2=C4A2; C2A2=C5A2; C3A2=C4A2; C3A2=C5A2; C4A2=C5A2; C1A3=C2A3; C1A3=C3A3; C1A3=C4A3; C1A3=C5A3; C2A3=C3A3; C2A3=C4A3; C2A3=C5A3; C3A3=C4A3; C3A3=C5A3; C4A3=C5A3; C1A4=C2A4; C1A4=C3A4; C1A4=C4A4; C1A4=C5A4; C2A4=C3A4; C2A4=C4A4; C2A4<C5A4; C3A4=C4A4; C3A4<C5A4; C4A4<C5A4

[j] *N. B.*: Corresponding χ^2 occurs at $p < .001$

[k] A1<A2; A1<A3; A1<A4; A2=A3; A2=A4; A3>A4

[l] C1A1=C2A1; C1A1=C3A1; C1A1=C4A1; C1A1=C5A1; C2A1=C3A1; C2A1=C4A1; C2A1=C5A1; C3A1=C4A1; C3A1=C5A1; C4A1=C5A1; C1A2=C2A2; C1A2=C3A2; C1A2<C4A2; C1A2=C5A2; C2A2=C3A2; C2A2=C4A2; C2A2=C5A2; C3A2=C4A2; C3A2=C5A2; C4A2=C5A2; C1A3=C2A3; C1A3=C3A3; C1A3<C4A3; C1A3=C5A3; C2A3=C3A3; C2A3<C4A3; C2A3=C5A3; C3A3=C4A3; C3A3=C5A3; C4A3>C5A3; C1A4<C2A4; C1A4<C3A4; C1A4<C4A4; C1A4=C5A4; C2A4=C3A4; C2A4=C4A4; C2A4=C5A4; C3A4=C4A4; C3A4=C5A4; C4A4=C5A4

third and fourth sections, and the mean of the third section was larger than that of the fourth section.

Also, there were differences among the means of the subjects in the cells defined by the combination of the type-frequency and trials factors. The results of subsequent analyses indicated that the following relationships were present. In section one, null relationships obtained. In section two, the C1 (100 percent success) group had a lower mean than the C4 (100 percent failure) group and no differences were apparent in the other comparisons. In section three, the meansof the C1, C2 (66 percent success, 33 percent failure), and C5 (level of aspiration control) groups all were lower than the mean of the C4 group; in all other comparisons, the means were equivalent. In section four, the mean of the C1 group was lower than those of the C2, the C3 (33 percent success, 66 percent failure), and C4 groups; in the remaining comparisons, the means did not differ.

There was no evidence that differences occurred among the means of the levels or orientation groups or, other than those cited, of any cell formed by the combination of levels, treatments, and/or trials.

Direction of Goal Changes After Success or Failure

Listed in Table 71 is the information about the frequencies with which the subjects who received the different conditions of reinforcement on the RLN changed their goals in the several directions. Only two differences occurred: on trial 13, the B2D2C3 group of subjects raised their goals after success information significantly less often than did the B1D2C1 and B2D1C1 groups of subjects; and, on trial 15, the B1D2C3 group of subjects raised their goals after success information significantly less often than did the B1D1C1, B1D2C1, B2D1C1, and B2D2C2 groups of subjects. Otherwise, the subjects generally tended to respond in a similar fashion after they received success and failure information: after success they raised their goals and after failure they lowered them.

Concept Formation Verbal Task

Tables 72 through 88 are composed of the data reflecting the subjects' learning performance and level of aspiration responses on the CFV. These data may be categorized as follows: attainment time scores, Tables 72, 73, and 74; number of responses scores, Tables 75, 76, and 77; absolute goal discrepancy scores, Tables 78, 79, and 80; positive goal discrepancy scores, Tables 81, 82, 83; and negative goal discrepancy scores, Tables 84, 85, and 86. In Table 87 may be found the summary of the results of the statistical tests; information about direction of goal changes is in Table 88.

TABLE 71

COMPARISON OF THE GROUPS IN TERMS OF DIRECTIONS OF GOAL CHANGE AFTER SUCCESS AND FAILURE: ROTE LEARNING NON-VERBAL TASK (FREQUENCIES)

Comparison	Trial 3				Trial 4				Trial 11				Trial 12			
	Direction				Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	8	0	0	8	8	0	0	8	7	1	0	8	8	0	0	8
B1D1C2	8	0	0	8	8	0	0	8	5	0	3	8	6	0	2	8
B1D1C5	1	0	2	3	2	1	1	4	4	0	0	4	2	1	1	4
B1D2C1	8	0	0	8	8	0	0	8	8	0	0	8	8	0	0	8
B1D2C2	7	1	0	8	8	0	0	8	7	0	1	8	7	0	1	8
B1D2C5	3	0	1	4	3	0	0	3	2	1	0	3	1	0	1	2
B2D1C1	7	0	1	8	8	0	0	8	8	0	0	8	8	0	0	8
B2D1C2	6	1	1	8	8	0	0	8	7	0	1	8	6	1	1	8
B2D1C5	5	0	0	5	4	1	0	5	2	1	0	3	1	2	0	3
B2D2C1	7	0	1	8	8	0	0	8	6	0	2	8	8	0	0	8
B2D2C2	7	0	1	8	7	1	0	8	5	2	1	8	6	1	1	8
B2D2C5	4	0	0	4	5	0	1	6	4	0	0	4	3	0	0	3
B3D1C1	7	0	1	8	7	0	1	8	6	0	2	8	6	0	2	8
B3D1C2	5	1	2	8	6	1	1	8	3	4	1	8	6	2	0	8
B3D1C5	4	0	0	4	4	0	0	4	1	0	0	1	4	0	0	4
B3D2C1	8	0	0	8	8	0	0	8	7	1	0	8	7	1	0	8
B3D2C2	8	0	0	8	7	1	0	8	6	1	1	8	7	1	0	8
B3D2C5	5	0	0	5	3	0	0	3	4	0	0	4	4	0	0	4
	Trial 3				Trial 4				Trial 11				Trial 12			
	Direction				Direction				Direction				Direction			
	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T
B1D1C3	0	6	2	8	2	5	1	8	3	4	1	8	1	6	1	8
B1D1C4	1	6	1	8	1	7	0	8	3	4	1	8	0	8	0	8
B1D1C5	1	3	0	4	1	3	0	4	0	2	2	4	0	3	1	4
B1D2C3	1	6	1	8	0	6	2	8	0	6	2	8	1	6	1	8
B1D2C4	1	6	1	8	1	6	1	8	2	5	1	8	1	7	0	8
B1D2C5	0	3	1	4	1	4	0	5	1	3	1	5	1	4	1	6
B2D1C3	0	7	1	8	2	5	1	8	0	7	1	8	3	4	1	8
B2D1C4	0	6	2	8	0	8	0	8	1	7	0	8	1	7	0	8
B2D1C5	0	2	1	3	0	2	1	3	2	2	1	5	0	4	1	5
B2D2C3	2	6	0	8	0	7	1	8	2	6	0	8	0	8	0	8
B2D2C4	0	7	1	8	2	6	0	8	1	6	1	8	0	7	1	8
B2D2C5	0	4	0	4	1	1	0	2	0	4	0	4	2	3	0	5
B3D1C3	0	7	1	8	1	7	0	8	0	7	1	8	1	5	2	8
B3D1C4	2	4	2	8	1	6	1	8	1	7	0	8	1	6	1	8
B3D1C5	0	4	0	4	2	2	0	4	0	6	1	7	0	4	0	4
B3D2C3	0	5	3	8	0	7	1	8	1	5	2	8	0	6	2	8
B3D2C4	0	8	0	8	0	8	0	8	0	8	0	8	0	8	0	8
B3D2C5	1	0	1	2	0	5	0	5	0	3	1	4	1	3	0	4

TABLE 71--Continued

Comparison	Trial 5				Trial 8				Trial 9				Trial 13			
	Direction				Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	7	0	1	8	7	1	0	8	8	0	0	8	7	0	1	8
B1D1C2	7	0	1	8	5	0	3	8	7	0	1	8	6	0	2	8
B1D1C3	7	1	0	8	5	3	0	8	5	2	1	8	6	2	0	8
B1D1C5	1	1	1	3	3	0	0	3	4	0	0	4	3	1	0	4
B1D2C1	8	0	0	8	8	0	0	8	8	0	0	8	8[a]	0	0	8
B1D2C2	8	0	0	8	7	0	1	8	7	0	1	8	6	1	1	8
B1D2C3	4	3	1	8	4	2	2	8	5	2	1	8	3	4	1	8
B1D2C5	3	0	0	3	4	0	0	4	1	0	0	1	0	0	2	2
B2D1C1	7	0	1	8	7	0	1	8	8	0	0	8	8[a]	0	0	8
B2D1C2	5	0	3	8	6	2	0	8	7	0	1	8	7	0	1	8
B2D1C3	8	0	0	8	8	0	0	8	8	0	0	8	8	0	0	8
B2D1C5	5	0	0	5	2	0	2	4	4	0	0	4	2	0	0	2
B2D2C1	8	0	0	8	8	0	0	8	6	0	2	8	7	0	1	8
B2D2C2	8	0	0	8	7	0	1	8	7	0	1	8	6	1	1	8
B2D2C3	5	0	3	8	5	1	2	8	6	1	1	8	2[a]	5	1	8
B2D2C5	4	1	0	5	5	0	0	5	4	0	0	4	2	0	0	2
B3D1C1	7	0	1	8	5	1	2	8	6	0	2	8	6	0	2	8
B3D1C2	5	1	2	8	4	2	2	8	5	2	1	8	5	2	1	8
B3D1C3	7	0	1	8	7	0	1	8	6	0	2	8	6	2	0	8
B3D1C5	4	1	0	5	7	0	0	7	2	0	0	2	4	0	1	5
B3D2C1	7	1	0	8	8	0	0	8	7	1	0	8	7	1	0	8
B3D2C2	6	2	0	8	7	0	1	8	7	1	0	8	7	1	0	8
B3D2C3	6	1	1	8	5	1	2	8	7	0	1	8	5	1	2	8
B3D2C5	5	0	0	5	4	0	0	4	4	1	1	6	0	1	0	1
	Trial 6				Trial 7				Trial 10				Trial 14			
	Direction				Direction				Direction				Direction			
	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T
B1D1C2	0	8	0	8	0	6	2	8	0	3	5	8	0	4	4	8
B1D1C3	1	6	1	8	3	3	2	8	2	3	3	8	1	7	0	8
B1D1C4	0	8	0	8	1	7	0	8	0	8	0	8	0	8	0	8
B1D1C5	0	2	0	2	0	3	1	4	0	1	1	2	1	5	0	6
B1D2C2	1	6	1	8	0	8	0	8	0	6	2	8	0	7	1	8
B1D2C3	2	3	3	8	0	6	2	8	1	4	3	8	0	6	2	8
B1D2C4	1	6	1	8	2	6	0	8	1	7	0	8	3	5	0	8
B1D2C5	2	1	2	5	1	1	1	3	0	2	1	3	1	3	1	4
B2D1C2	0	6	2	8	1	5	2	8	1	5	2	8	1	6	1	8
B2D1C3	0	7	1	8	0	6	2	8	0	6	2	8	1	6	1	8
B2D1C4	2	6	0	8	2	6	0	8	4	4	0	8	1	7	0	8
B2D1C5	0	0	3	3	2	2	1	5	1	1	1	3	1	3	1	5
B2D2C2	0	7	1	8	4	4	0	8	0	8	0	8	1	5	2	8
B2D2C3	0	7	1	8	0	7	1	8	0	6	2	8	3	4	1	8
B2D2C4	1	6	1	8	2	6	0	8	0	6	2	8	3	5	0	8
B2D2C5	0	4	1	5	0	1	0	1	0	1	1	2	1	4	0	5
B3D1C2	0	5	3	8	2	5	1	8	2	4	2	8	1	4	3	8
B3D1C3	0	6	2	8	0	7	1	8	1	6	1	8	0	8	0	8
B3D1C4	1	5	2	8	1	6	1	8	0	7	1	8	1	5	2	8
B3D1C5	0	6	0	6	0	6	0	6	0	2	1	3	0	3	0	3
B3D2C2	0	8	0	8	2	5	1	8	1	7	0	8	0	8	0	8
B3D2C3	0	8	0	8	3	5	0	8	0	5	3	8	1	5	2	8
B3D2C4	1	7	0	8	0	8	0	8	1	7	0	8	0	8	0	8
B3D2C5	1	2	1	4	0	4	1	5	0	2	1	3	1	1	1	3

TABLE 71--Continued

Comparison	Trial 15				Trial 16				Trial 17			
	Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	8[b]	0	0	8	7	0	1	8	7	1	0	8
B1D1C2	7	0	1	8	8	0	0	8	6	1	1	8
B1D1C3	6	2	0	8	7	1	0	8	6	1	1	8
B1D1C4	7	1	0	8	8	0	0	8	7	1	0	8
B1D1C5	4	0	1	5	4	0	0	4	3	0	0	3
B1D2C1	8[b]	0	0	8	8	0	0	8	8	0	0	8
B1D2C2	7	0	1	8	7	0	1	8	7	0	1	8
B1D2C3	2[b]	4	2	8	3	3	2	8	3	3	2	8
B1D2C4	6	2	0	8	7	0	1	8	8	0	0	8
B1D2C5	3	0	0	3	2	0	0	2	3	0	0	3
B2D1C1	8[b]	0	0	8	8	0	0	8	8	0	0	8
B2D1C2	6	2	0	8	6	2	0	8	6	1	1	8
B2D1C3	7	1	0	8	6	1	1	8	8	0	0	8
B2D1C4	4	3	1	8	5	3	0	8	5	3	0	8
B2D1C5	4	0	1	5	2	0	0	2	4	1	0	5
B2D2C1	7	0	1	8	8	0	0	8	7	0	1	8
B2D2C2	8[b]	0	0	8	7	1	0	8	5	3	0	8
B2D2C3	4	2	2	8	6	0	2	8	4	3	1	8
B2D2C4	6	0	2	8	5	1	2	8	4	0	4	8
B2D2C5	2	1	2	5	0	0	0	0	6	0	0	6
B3D1C1	6	0	2	8	6	0	2	8	6	0	2	8
B3D1C2	5	3	0	8	5	2	1	8	5	2	1	8
B3D1C3	7	0	1	8	8	0	0	8	7	1	0	8
B3D1C4	6	0	2	8	5	0	3	8	8	0	0	8
B3D1C5	3	1	0	4	2	1	0	3	4	0	0	4
B3D2C1	7	1	0	8	7	1	0	8	7	1	0	8
B3D2C2	6	1	1	8	8	0	0	8	6	2	0	8
B3D2C3	5	2	1	8	6	1	1	8	4	1	3	8
B3D2C4	4	2	2	8	5	1	2	8	4	2	2	8
B3D2C5	1	1	1	3	4	0	1	5	1	0	1	2

[a] Trial 13, SR: B2D2C3 < B1D2C1, and B2D1C1.

[b] Trial 15, SR: B1D2C3 < B1D1C1, B1D2C1, B2D1C1, and B2D2C2.

Learning Performance

Attainment Time

The relationships among the measures of the variability of the subjects' attainment time scores on the CFV are reflected in the figures included in Table 72 and Column 2 of Table 87. Homogeneity of variance was apparent in the scores of the subjects in the two orientation groups, the three levels groups, and the six type-frequency groups, and the subjects' scores during the four sections of trials. Within the retarded and normal groups, the same relationships occurred. Within the superior group, homogeneity was evident in the scores in the orientation and type-frequency categories but not in the scores in the trials classification.

Data pertinent to the subjects' mean attainment times on the CFV are listed in Tables 73 and 74 and Column 8 in Table 87. Differences did occur among the means of the scores in the sections of trials. Further analyses indicated that the mean of the first section of trials was larger than those of the three succeeding sections; the mean of the second section was larger than that of the third section; and there were no differences between the means of sections two and four or of sections three and four.

There were differences among the means of the three levels groups. The existing relationships were these: the mean of the retarded group was higher than those of the normal and superior groups; whereas, the means of the normal and superior groups were equivalent. In addition, differences were present among the means of the cells defined by the overlap of levels and trials. The differences were located in this manner. On all four sections of trials, the same relationships were evident: the mean of the retarded group was larger than those of the normal and superior groups and the mean of the normal group was larger than that of the superior group. One comment about the relationship between the means of the normal and superior groups is appropriate. In each comparison, the attainment time difference was small (1.50, 0.84, 1.00, and 0.98 seconds for the four sections respectively); yet the error terms were so small that statistical, if not practical, significance obtained. The differences among the means of the retarded and the normal and the retarded and superior groups were larger.

There is no evidence that other than null relationships were present among the means in the remaining comparisons.

Number of Reponses

Contained in Table 75 and Column 3 of Table 87 are the data reflecting the variability of the subjects' number of responses scores on the CFV. Over the total group of subjects, heterogeneity

TABLE 72

COMPARISON OF THE GROUPS IN TERMS OF ATTAINMENT TIME: CONCEPT FORMATION VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
						B1			B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	383	64	50.224***							
	B2		383	34								
	B3		383	36								
D	D1	1	575	50	0.242	191	59	1.443	39	3.813	30	4.208
	D2		575	52		191	70		29		41	
C	C1	5	191	39	34.793***	63	44	34.035***	42	20.919***	26	11.741
	C2		191	49		63	82		23		31	
	C3		191	81		63	112		49		44	
	C4		191	45		63	61		21		26	
	C5		191	47		63	53		41		35	
	C6		191	43		63	29		24		50	
A	A1	3	287	72	73.397***	95	97	33.932***	45	22.078***	50	21.101***
	A2		287	43		95	53		21		28	
	A3		287	30		95	35		20		22	
	A4		287	32		95	36		20		24	

***$p < .001$

TABLE 73

DESCRIPTION OF THE GROUPS IN TERMS OF ATTAINMENT TIME: CONCEPT FORMATION VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	22	17	16	16	23	17	15	16	19	14	14	15
		C2	27	24	22	21	24	18	18	18	23	16	16	16
		C3	33	28	23	21	25	17	17	16	16	12	11	12
		C4	24	24	20	19	19	15	14	13	20	16	15	16
		C5	29	22	19	20	22	17	17	21	20	16	15	15
		C6	28	23	20	21	20	16	15	15	20	17	16	17
	D2	C1	26	22	20	21	23	16	16	16	25	17	16	16
		C2	30	21	20	19	22	16	16	17	22	18	17	17
		C3	27	22	19	20	26	20	19	18	22	17	16	17
		C4	28	24	22	20	21	17	16	16	18	14	14	14
		C5	28	23	20	19	22	16	15	15	24	19	17	18
		C6	26	23	20	20	20	15	15	16	20	14	14	15

TABLE 74

COMPARISON OF THE GROUPS IN TERMS OF ATTAINMENT TIME: CONCEPT FORMATION VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	287	5,222.43		
B	2	884.77	442.39	28.36***
D	1	9.52	9.52	-
C	5	61.25	12.25	-
BD	2	13.51	6.76	-
BC	10	115.33	11.53	-
DC	5	43.86	8.77	-
BDC	10	162.29	16.23	1.04
Error (b)	252	3,931.90	15.60	
Within Subjects	864	2,092.05		
A	3	945.01	315.00	236.84***
BA	6	36.58	6.10	4.59***
DA	3	3.15	1.05	-
CA	15	20.69	1.38	1.04
BDA	6	1.77	0.30	-
BCA	30	28.00	0.93	-
DCA	15	8.91	0.59	-
BDCA	30	38.44	1.28	-
Error (w)	756	1,009.50	1.33	
Total	1,151	7,314.48		

TABLE 74--Continued

B. INDIVIDUAL COMPARISONS

Comparison	$\overline{X}$	B1:22.48	B2:17.85	B3:16.83	
B	Group	B1 > B2	B1 > B3	B2 = B3	
	Diff.	4.63	5.65	1.02	
	t	9.078***	11.078***	2.372	
A	$\overline{X}$	A1:23.44	A2:18.42	A3:17.08	A4:17.28
	Group	A1 > A2	A1 > A3	A1 > A4	A2 > A3
	Diff.	5.02	6.36	6.16	1.34
	t	7.968***	10.780***	10.267***	2.680**
	Group	A2 = A4	A3 = A4		
	Diff.	1.14	0.20		
	t	2.235	0.435		
BA	$\overline{X}$	B1A1:27.33	B2A1:22.25	B3A1:20.75	B1A2:22.75
	Group	B1A1 > B2A1	B1A1 > B3A1	B2A1 > B3A1	B1A2 > B2A2
	Diff.	5.08	6.58	1.50	6.08
	t	4.940***	6.384***	4.772***	21.917***
	$\overline{X}$	B2A2:16.67	B3A2:15.83	B1A3:20.08	B2A3:16.08
	Group	B1A2 > B3A2	B2A2 > B3A2	B1A3 > B2A3	B1A3 > B3A3
	Diff.	6.92	0.84	4.00	5.00
	t	23.837***	3.723***	16.729***	20.533***
	$\overline{X}$	B3A3:15.08	B1A4:19.75	B2A4:16.25	B3A4:15.67
	Group	B2A3 > B3A3	B1A4 > B2A4	B1A4 > B3A4	B2A4 > B3A4
	Diff.	1.00	3.50	4.08	0.98
	t	4.784***	11.460***	16.320***	4.579***

**p < .01

***p < .001

TABLE 75

COMPARISON OF THE GROUPS IN TERMS OF NUMBER OF RESPONSES: CONCEPT FORMATION VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	383	3	6.277							
	B2		383	2								
	B3		383	2								
D	D1	1	575	3	3.255	191	2	0.346	2	3.00	2	4.543
	D2		575	2		191	3		2		2	
C	C1	5	191	3	3.403	63	2	1.281	2	11.543	1	17.741***
	C2		191	3		63	3		2		3	
	C3		191	3		63	3		2		2	
	C4		191	2		63	2		2		2	
	C5		191	3		63	3		2		2	
	C6		191	2		63	2		1		2	
A	A1	3	287	2	34.328***	95	1	19.940***	1	2.866	1	8.233
	A2		287	3		95	3		2		2	
	A3		287	2		95	3		2		2	
	A4		287	2		95	3		2		2	

** $p < .01$

*** $p < .001$

of variance existed in the subjects' scores at the several sections of trials while equivalent variability occurred in the scores of the subjects in the three levels groups, the two orientation groups, and the six type-frequency groups. Consistent relationships were present within the retarded group. Within the normal group, there was equivalent variability in the scores of the subjects when these scores were classified according to orientation, type-frequency, and trials. Within the superior group, homogeneity of variance characterized the subjects' scores when they were categorized according to orientation and trials. This did not happen when they were classified according to type-frequency; here, heterogeneity of variance was present.

Tables 76 and 77 and Column 9 of Table 87 are composed of statistics which pertain to the central tendencies in the subjects' number of responses scores on the CFV. Differences did occur among the means of the several sections of trials: viz, the mean of the first section of trials was higher than those of the second, third, and fourth sections; the mean of the second section was higher than that of the third section and equivalent to that of the fourth section; further, the mean of the third section equalled that of the fourth section.

There were differences among the intelligence groups and these differences were like those manifested in attainment time; i. e., the retarded group had a higher mean than either the normal or superior group, and these latter groups did not differ in terms of mean performance. Further, there was evidence that the means of the scores in the cells defined by the combination of levels and trials differed. The nature of these differences may be listed as follows. On every section of trials, the pattern of differences was similar: the mean of the retarded group exceeded those of the normal and superior groups and the means of these latter groups were equivalent.

There were also differences among the means of the subjects receiving the six type-frequency sets of information. The obtained differences were these: the mean of the C1 group (100 percent success) was lower than that of the C2 group (66 percent success, 33 percent failure) but equivalent to the means of the other four groups. The mean of the C2 group was larger than those of the C4 (100 percent failure) and C6 (speed and accuracy control) groups and equal to those of the C3 (33 percent success, 66 percent failure) and C5 (level of aspiration control) groups. The C5 group had a larger mean than the C6 group. No differences occurred in these comparisons: the C3 and C4 groups, the C3 and C5 groups, the C3 and C6 groups, the C4 and C5 groups, and the C4 and C6 groups. There were no differences between the means of the two orientation groups or, other than the BA interaction, among the means of the groups defined by any combination of treatments, levels, and/or trials.

TABLE 76

DESCRIPTION OF THE GROUPS IN TERMS OF NUMBER OF RESPONSES: CONCEPT FORMATION VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	7	6	5	6	6	4	4	4	5	4	3	4
		C2	7	7	6	6	7	6	6	6	6	4	5	4
		C3	7	6	5	5	6	4	4	4	6	4	4	4
		C4	6	7	6	6	6	4	4	4	6	4	4	4
		C5	7	6	6	6	6	5	5	4	6	4	4	4
		C6	7	6	6	6	5	3	3	4	5	4	4	4
	D2	C1	7	6	5	6	6	4	4	4	5	3	4	4
		C2	7	6	6	6	6	4	4	5	5	4	4	5
		C3	7	6	5	5	6	5	4	4	6	5	5	5
		C4	7	6	5	5	5	4	4	4	6	4	4	4
		C5	7	6	6	5	6	4	4	4	6	5	4	4
		C6	7	6	5	5	5	4	3	4	4	4	4	4

TABLE 77

COMPARISON OF THE GROUPS IN TERMS OF NUMBER OF RESPONSES: CONCEPT FORMATION VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	287	264.10		
B	2	66.62	33.31	48.98***
D	1	1.98	1.98	2.91
C	5	12.06	2.41	3.54**
BD	2	0.47	0.24	-
BC	10	4.64	0.46	-
DC	5	3.35	0.67	-
BDC	10	2.39	0.24	-
Error (b)	252	172.59	0.68	
Within Subjects	864	122.97		
A	3	45.32	15.11	188.88***
BA	6	3.42	0.57	7.12***
DA	3	0.05	0.02	-
CA	15	1.70	0.11	1.38
BDA	6	0.68	0.11	1.38
BCA	30	1.77	0.06	-
DCA	15	0.79	0.05	-
BDCA	30	2.08	0.07	-
Error (w)	756	67.16	0.08	
Total	1,151	387.07		

TABLE 77--Continued

B. INDIVIDUAL COMPARISONS

Comparison	$\overline{X}$	B1:6.04	B2:4.69	B3:4.46		
B	Group	B1 > B2	B1 > B3	B2 = B3		
	Diff.	1.35	1.58	0.23		
	t	11.250***	13.167***	2.30		
C	$\overline{X}$	C1:4.83	C2:5.50	C3:5.08	C4:4.96	
	Group	C1 < C2	C1 = C3	C1 = C4	C1 = C5	C1 = C6
	Diff.	0.67	0.25	0.13	0.34	0.16
	t	3.722***	1.389	0.812	1.889	1.000
	$\overline{X}$	C5;5.17	C6:4.67			
C	Group	C2 = C3	C2 > C4	C2 = C5	C2 > C6	C3 = C4
	Diff.	0.42	0.54	0.33	0.83	0.12
	t	2.333	3.376***	1.833	5.188***	0.750
	Group	C3 = C5	C3 = C6	C4 = C5	C4 = C6	C5 > C6
	Diff.	0.09	0.41	0.21	0.29	0.50
	t	0.500	2.562	1.312	2.000	3.125**
A	$\overline{X}$	A1:6.08	A2:4.94	A3:4.56	A4:4.67	
	Group	A1 > A2	A1 > A3	A1 > A4	A2 > A3	A2 = A4	A3 = A4
	Diff.	1.14	1.52	1.41	0.38	0.27	0.11
	t	8.769***	12.667***	11.750***	2.923**	2.077	0.917
BA	$\overline{X}$	B1A1:6.91	B2A1:5.83	B3A1:5.50	B1A2:6.16	
	Group	B1A1 > B2A1	B1A1 > B3A1	B2A1 = B3A1	B1A2 > B2A2	
	Diff.	1.08	1.41	0.33	1.58	
	t	7.453***	9.730***	2.277	6.899***	
	$\overline{X}$	B2A2:4.58	B3A2:4.08	B1A3:5.50	B2A3:4.08	
	Group	B1A2 > B3A2	B2A2 = B3A2	B1A3 > B2A3	B1A3 > B3A3	
	Diff.	2.08	0.50	1.42	1.42	
	t	9,082***	2.440	6.200***	6.200***	
	$\overline{X}$	B3A3:4.08	B1A4:5.58	B2A4:4.25	B3A4:4.16	
	Group	B2A3 = B3A3	B1A4 > B2A4	B1A4 > B3A4	B2A4 = B3A4	
	Diff.	0.00	1.33	1.42	0.09	
	t	–	5.807***	6.200***	0.439	

** p < .01

*** p < .001

Level of Aspiration Responses

Absolute Goal Discrepancy Scores

The variability of the subjects' absolute goal discrepancy scores related to CFV performance is indicated by the data of which Table 78 and Column 4 of Table 87 consist. When the total group of subjects was considered, it was evident that the scores of the subjects who received the two orientations were homogeneous whereas those of the subjects in the three levels groups and the six type-frequency groups and the scores in the several sections of trials were extremely heterogeneous. Consistent relationships may be observed within the normal and superior groups. Within the retarded group, there were differences among the variances of the scores of the subjects in the type-frequency groups; conversely, the subjects' scores in the four sections of trials and the scores of subjects in the two orientation groups were equal in terms of variability.

Tables 79 and 80 and Column 10 of Table 87 contain information about the subjects' mean absolute goal discrepancy scores for the CFV performance. No differences were evident among the means of the scores in the levels groups, the treatments groups, the sections of trials, and, with one exception, in any groups defined by the overlap of trials, levels, and/or treatments. The one exception was related to the BDA interaction. Subsequent analyses of the differences implied by this result of a generalized comparison were not considered warranted for this reason: the separate F-ratios associated with the B, D, and A factors were not significant, but, the chi squares associated with the B, and, in three out of four comparisons, the A factor were significant; as a result, the meaning of differences related to the BDA interaction was considered unclear.

Positive Goal Discrepancy Scores

In Table 81 and Column 5 of Table 87 are summarized the data reflecting the variability of the subjects' positive goal discrepancy scores on the CFV. Within the total group of subjects, there was extreme heterogeneity of the variance of the scores of the levels groups and the treatments groups; however, the score variability was constant in the four sections of trials. Within the retarded and superior groups, heterogeneity was present in the scores when they were analyzed according to the three classifications: orientation, type-frequency, and trials. Within the normal group, the same statement applies to the latter two categories but homogeneity of variance existed in the scores of the subjects classified according to orientation.

TABLE 78

COMPARISON OF THE GROUPS IN TERMS OF ABSOLUTE DISCREPANCY SCORES: CONCEPT FORMATION VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
						B1			B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	319	9	123.301***							
	B2		319	8								
	B3		319	23								
D	D1	1	479	12	1.653	159	9	1.722	9	2.493	19	4.891
	D2		479	14		159	8		7		26	
C	C1	4	191	5	120.535***	63	7	35.998***	4	33.341***	4	111.791***
	C2		191	13		63	6		5		26	
	C3		191	19		63	4		15		37	
	C4		191	20		63	16		7		37	
	C5		191	7		63	9		5		6	
A	A1	3	239	17	34.863***	79	9	5.381	15	48.697***	27	36.098***
	A2		239	11		79	7		4		22	
	A3		239	15		79	7		5		33	
	A4		239	9		79	11		7		8	

***$p < .001$

TABLE 79

DESCRIPTION OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: CONCEPT FORMATION-VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	2	4	4	4	4	3	4	3	3	2	3	3
		C2	4	3	3	3	2	2	2	2	6	3	3	3
		C3	2	3	3	2	6	2	3	2	2	3	3	3
		C4	4	5	5	4	3	5	5	2	3	5	9	5
		C5	4	3	2	3	2	2	2	2	2	2	2	2
	D2	C1	2	1	3	2	4	3	4	3	3	4	3	3
		C2	3	3	2	2	2	3	3	3	8	4	3	4
		C3	2	4	3	2	5	2	2	2	4	7	6	3
		C4	3	5	4	4	2	4	4	4	3	4	6	3
		C5	3	5	4	4	4	2	2	3	3	3	2	3

TABLE 80

COMPARISON OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: CONCEPT FORMATION VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	873.16		
B	2	6.15	3.08	-
D	1	0.85	0.85	-
C	4	26.39	6.60	1.77
BD	2	4.87	2.44	-
BC	8	30.46	3.81	1.02
DC	4	8.24	2.06	-
BDC	8	14.39	1.80	-
Error (b)	210	781.81	3.72	
Within Subjects	720	675.54		
A	3	3.71	1.24	1.36
BA	6	4.05	0.68	-
DA	3	1.07	0.36	-
CA	12	33.19	2.77	3.04***
BDA	6	6.79	1.13	1.24
BCA	24	36.92	1.54	1.69
DCA	12	6.57	0.55	-
BDCA	24	12.93	0.54	-
Error (w)	630	570.31	0.91	
Total	959	1,548.70		

*** $p < .001$

TABLE 81

COMPARISON OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: CONCEPT FORMATION VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	319	14	29.592***							
	B2		319	8								
	B3		319	10								
D	D1	1	479	8	39.867***	159	9	26.631***	9	1.259	6	31.863***
	D2		479	14		159	20		7		14	
C	C1	4	191	4	192.597***	63	3	157.165***	5	30.177***	3	89.615***
	C2		191	5		63	5		6		3	
	C3		191	14		63	5		15		22	
	C4		191	21		63	44		6		11	
	C5		191	8		63	11		6		8	
A	A1	3	239	10	2.550	79	9	13.574**	15	46.846***	5	26.080***
	A2		239	10		79	12		3		15	
	A3		239	11		79	17		6		11	
	A4		239	11		79	19		8		7	

$^{**}p < .01$

$^{***}p < .001$

Information about the central tendencies of the positive goal discrepancy scores on the CFV is included in Tables 82 and 83 and Column 11 of Table 87. Here, differences were present among the means of the four section of trials. Further analyses revealed the differences to be these: the mean of the first section was smaller than those of the second and third sections; the means in all other combinations were equivalent.

In addition, there were differences among the means of the six type-frequency groups: the mean of the C1 (100 percent success) group was smaller than those of the C2 (66 percent success, 33 percent failure), C3 (33 percent success, 66 percent failure), C4 (100 percent failure), and C5 (level of aspiration control) groups; the mean of the C2 group was smaller than that of the C4 group but equivalent to those of the C3 and C5 groups; the mean of the C3 group was smaller than that of the C4 group; and the mean of the C5 group was smaller than those of the C3 and C4 groups.

Consistent with these results is the observation that differences were present among the means of the cells formed by the overlap of the trials and type-frequency factors. These differences were localized in this way. On the first section of trials, the means in each comparison were equivalent. On the second section, the mean of the C1 group was lower than those of the C2, C3, C4, and C5 groups; in all other comparisons, the pairs of means did not differ. On the third section, the mean of the C4 group was larger than those of the C1 and C5 groups; all other means were equal. On the fourth section, the differences between means in all comparisons did not deviate from zero.

No differences occurred among the means of the levels groups or between the means of the groups receiving the two orientations. Further, other than the differences indicated by the CA interaction, there was no evidence that differences were present among any subgroups formed by the overlap of levels, treatments, and/or trials.

Negative Goal Discrepancy Scores

The data of which Table 84 and Column 6 of Table 87 are composed represent the variability of the subjects' negative goal discrepancy scores for the CFV. When the total group of 288 subjects was considered, extreme heterogeneity of variance existed among the scores when they were classified according to levels, treatments, and sectionsof trials. The same statement applies within the superior group. Within the retarded and normal groups, homogeneity of variance was present when the scores were categorized according to orientation and trials, and marked heterogeneity was apparent when the scores were classified according to type-frequency.

The information which may be found in Tables 85 and 86 and Column 12 of Table 87 refers to the means of the negative goal

TABLE 82

DESCRIPTION OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: CONCEPT FORMATION VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	1	2	2	2	3	0	2	1	2	1	1	2
		C2	1	3	2	2	2	3	2	1	1	2	2	2
		C3	1	3	4	2	4	2	3	1	2	3	3	1
		C4	3	5	4	3	3	3	4	1	2	3	2	4
		C5	4	3	2	3	1	2	2	2	1	2	1	1
	D2	C1	0	1	2	2	1	1	1	0	0	1	1	2
		C2	2	3	2	2	1	2	3	3	0	3	2	1
		C3	2	3	3	1	5	2	3	2	1	6	5	1
		C4	2	6	6	6	1	3	4	4	2	3	5	2
		C5	2	5	3	2	2	1	1	3	3	2	1	3

TABLE 83

COMPARISON OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: CONCEPT FORMATION VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	660.84		
B	2	11.58	5.79	2.15
D	1	1.33	1.33	-
C	4	57.66	14.42	5.36***
BD	2	0.16	0.08	-
BC	8	13.28	1.66	-
DC	4	3.52	0.88	-
BDC	8	8.11	1.01	-
Error (b)	210	565.20	2.69	
Within Subjects	720	632.84		
A	3	14.68	4.89	5.89***
BA	6	10.03	1.67	2.01
DA	3	4.40	1.47	1.77
CA	12	23.45	1.95	2.35**
BDA	6	6.00	1.00	1.20
BCA	24	24.12	1.01	1.22
DCA	12	5.68	0.47	-
BDCA	24	20.97	0.87	1.05
Error (w)	630	523.51	0.83	
Total	959	1,293.68		

TABLE 83--Continued

B. INDIVIDUAL COMPARISONS

Comparison	$\overline{X}$	C1:1.21	C2:1.91	C3:2.61	C4:3.33	C5:2.13
C	Group	C1 < C2	C1 < C3	C1 < C4	C1 < C5	C2 = C3
	Diff.	0.70	1.40	2.12	0.92	0.70
	t	3.240**	4.575***	5.857***	3.665***	2.229
	Group	C2 < C4	C2 = C5	C3 < C4	C3 [illegible] C5	C4 > C5
	Diff.	1.42	0.22	0.72	0.48	1.20
	t	3.858***	0.266	5.325***	4.477***	3.077**
A	$\overline{X}$	A1:1.78	A2:2.61		A3:2.56	A4:2.04
	Group	A1 < A2	A1 < A3		A1 = A4	A2 = A3
	Diff.	0.83	0.78		0.26	0.05
	t	2.862**	2.689**		0.897	0.172
	Group	A2 = A4	A3 = A4			
	Diff.	0.57	0.52			
	t	1.965	1.793			
CA	$\overline{X}$	C1A1:1.17	C2A1:1.27		C3A1:2.48	C4A1:2.06
	Group	C1A1 = C2A1	C1A1 = C3A1		C1A1 = C4A1	C1A1 = C5A1
	Diff.	0.10	1.31		0.90	0.73
	t	0.228	1.904		1.617	1.292
	$\overline{X}$	C5A1:1.90	C1A2:0.98		C2A2:2.48	C3A2:3.21
	Group	C2A1 = C3A1	C2A1 = C4A1		C2A1 = C5A1	C3A1 = C4A1
	Diff.	1.21	0.79		0.62	0.42
	t	1.766	1.445		1.120	0.550
	$\overline{X}$	C4A2:3.79	C5A2:2.35		C1A3:1.40	C2A3:2.21
	Group	C3A1 = C5A1	C4A1 = C5A1		C1A2 < C2A2	C1A2 < C3A2
	Diff.	0.58	0.17		1.50	2.23
	t	0.765	0.259		4.273***	3.292**

TABLE 83--*Continued*

Comparison	$\overline{X}$	C3A2:3.35	C4A2:4.12	C5A2:1.71	C1A4:1.48
CA	Group	C1A2 < C4A2	C1A2 < C5A2	C2A2 = C3A2	C2A2 = C4A2
	Diff.	2.81	1.38	0.73	1.31
	t	5.039***	2.811**	1.029	2.205
	$\overline{X}$	C2A4:1.67	C3A4:1.40	C4A4:3.31	C5A4:2.35
	Group	C2A2 = C5A2	C3A2 = C4A2	C4A2 = C5A2	C3A2 = C5A2
	Diff.	0.12	0.58	1.44	0.85
	t	0.235	0.702	2.094	1.087
	Group	C1A3 = C2A3	C1A3 = C3A3	C1A3 < C4A3	C1A3 = C5A3
	Diff.	0.81	1.96	2.73	0.31
	t	2.224	1.145	3.252***	0.965
	Group	C2A3 = C3A3	C2A3 = C4A3	C2A3 = C5A3	C3A3 = C4A3
	Diff.	1.15	1.92	0.50	0.77
	t	0.670	2.276	1.515	0.412
	Group	C3A3 = C5A3	C4A3 > C5A3	C1A4 = C2A4	C1A4 = C3A4
	Diff.	1.65	2.42	0.19	0.083
	t	0.968	2.929**	0.386	0.200
	Group	C1A4 = C4A4	C1A4 = C5A4	C2A4 = C3A4	C2A4 = C4A4
	Diff.	1.83	0.88	0.27	1.65
	t	2.175	1.495	0.603	1.913
	Group	C2A4 = C5A4	C3A4 = C4A4	C3A4 = C5A4	C4A4 = C5A4
	Diff.	0.69	1.92	0.96	0.96
	t	1.126	2.332	1.726	1.042

$^{**}p < .01$

$^{***}p < .001$

TABLE 84

COMPARISON OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: CONCEPT FORMATION VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	319	7	220.409^{***}							
	B2		319	6								
	B3		319	26								
D	D1	1	479	11	12.081^{***}	159	8	1.705	6	0.091	19	10.924^{***}
	D2		479	15		159	6		6		32	
C	C1	4	191	7	162.144^{***}	63	9	17.466^{**}	7	36.372^{***}	5	176.346^{***}
	C2		191	14		63	7		2		31	
	C3		191	20		63	4		4		50	
	C4		191	19		63	10		10		39	
	C5		191	4		63	6		4		2	
A	A1	3	239	13	68.400^{***}	79	5	10.565	6	9.971	28	54.702^{***}
	A2		239	15		79	5		8		30	
	A3		239	18		79	9		6		37	
	A4		239	6		79	8		4		7	

$^{**}p < .01$

$^{***}p < .001$

TABLE 85

DESCRIPTION OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: CONCEPT FORMATION VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	1	2	3	3	2	4	4	3	1	2	2	1
		C2	2	2	4	2	0	1	1	1	4	2	2	1
		C3	1	1	1	1	1	1	2	2	0	1	2	3
		C4	1	2	2	1	0	2	2	2	1	4	8	1
		C5	1	1	1	1	1	2	2	2	1	2	2	1
	D2	C1	2	1	1	1	4	3	4	3	2	3	2	2
		C2	0	1	1	1	2	1	1	1	8	4	3	4
		C3	0	2	2	1	0	1	0	1	3	6	6	3
		C4	1	2	3	3	1	3	3	2	2	1	3	1
		C5	2	3	3	3	2	2	1	1	0	2	1	1

TABLE 86

COMPARISON OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: CONCEPT FORMATION VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	915.64		
B	2	15.90	7.95	2.11
D	1	1.67	1.67	–
C	4	10.21	2.55	–
BD	2	5.10	2.55	–
BC	8	42.07	5.26	1.40
DC	4	2.47	0.62	–
BDC	8	48.70	6.09	1.62
Error (b)	210	789.52	3.76	
Within Subjects	720	644.59		
A	3	18.08	6.03	7.01***
BA	6	3.84	0.64	–
DA	3	2.99	1.00	1.16
CA	12	22.46	1.87	2.17
BDA	6	2.79	0.47	–
BCA	24	26.63	1.11	1.29
DCA	12	13.79	1.15	1.34
BDCA	24	15.27	0.64	–
Error (w)	630	538.74	0.86	
Total	959	1,560.23		

B. INDIVIDUAL COMPARISONS

Comparison	$\bar{X}$	A1:1.56		A2:2.22	A3:2.47		A4:1.63
A	Group	A1 = A2	A1 = A3	A1 = A4	A2 = A3	A2 = A4	A3 > A4
	Diff.	0.66	0.91	0.07	0.25	0.59	0.84
	t	2.000	2.528	0.269	0.676	2.107	2.625**

**p < .01

***p < .001

TABLE 87

SUMMARY OF THE RESULTS OF THE COMPARISONS OF THE GROUPS IN TERMS OF THE RESPONSE MEASURES RELATED TO THE CONCEPT FORMATION VERBAL TASK

(1)			(2)	(3)	(4)	(5)	(6)
			χ^2				
Response Measure			Att.	No. R.	G. D. Ab.	G. D+	G. D-
Table			72	75	78	81	84
Comparison		B	.001	N.S.	.001	.001	.001
		D	N.S.	N.S.	N.S.	.001	.001
		C	.001	N.S.	.001	.001	.001
		A	.001	.001	.001	N.S.	.001
	B1	D	N.S.	N.S.	N.S.	.001	N.S.
		C	.001	N.S.	.001	.001	.01
		A	.001	.001	N.S.	.01	N.S.
	B2	D	N.S.	N.S.	N.S.	N.S.	N.S.
		C	.001	N.S.	.001	.001	.001
		A	.001	N.S.	.001	.001	N.S.
	B3	D	N.S.	N.S.	N.S.	.001	.001
		C	N.S.	.01	.001	.001	.001
		A	.001	N.S.	.001	.001	.001

(7)	(8)	(9)	(10)	(11)	(12)
	F				
Comparison	Att.	No. R.	G. D. Ab.	G. D+	G. D-
	74	77	80	83	86
B	.001[a]	.001[d]	N.S.	N.S.	N.S.
D	N.S.	N.S.	N.S.	N.S.	N.S.
C	N.S.	.01[e]	N.S.	.001[i]	N.S.
A	.001[b]	.001[f]	N.S.	.001[j]	.001[l]
BD	N.S.	N.S.	N.S.	N.S.	N.S.
BC	N.S.	N.S.	N.S.	N.S.	N.S.
DC	N.S.	N.S.	N.S.	N.S.	N.S.
BDC	N.S.	N.S.	N.S.	N.S.	N.S.
BA	.001[c]	.001[g]	N.S.	N.S.	N.S.
DA	N.S.	N.S.	N.S.	N.S.	N.S.
CA	N.S.	N.S.	N.S.	.01[k]	N.S.
BDA	N.S.	N.S.	.001[h]	N.S.	N.S.
BCA	N.S.	N.S.	N.S.	N.S.	N.S.
DCA	N.S.	N.S.	N.S.	N.S.	N.S.
BDCA	N.S.	N.S.	N.S.	N.S.	N.S.

[a] B1>B2; B1>B3; B2=B3

[b] A1>A2; A1>A3; A1>A4; A2>A3; A2=A4; A3=A4

[c] B1A1>B2A1; B1A1>B3A1; B2A1>B3A1; B1A2>B2A2; B1A2>B3A2; B2A2>B3A2; B1A3>B2A3; B1A3>B3A3; B2A3>B3A3; B1A4>B2A4; B1A4>B3A4; B2A4>B3A4

[d] B1>B2; B1>B3; B2=B3

[e] C1<C2; C1=C3; C1=C4; C1=C5; C1=C6; C2=C3; C2>C4; C2=C5; C2>C6; C3=C4; C3=C5; C3=C6; C4=C5; C4=C6; C5>C6

[f] A1>A2; A1>A3; A1>A4; A2>A3; A2=A4; A3=A4

[g] B1A1>B2A1; B1A1>B3A1; B2A1=B3A1; B1A2>B2A2; B1A2>B3A2; B2A2=B3A2; B1A3>B2A3; B1A3>B3A3; B2A3=B3A3; B1A4>B2A4; B1A4>B3A4; B2A4=B3A4

[h] N. B.: The F ratios associated with the B, D, and A factors were not significant and the χ^2's associated with the B, and, in three out of four comparisons, the A factors were significant; therefore, analyses of the simple effects associated with the BDA interaction were not considered warranted.

[i] C1<C2; C1<C3; C1<C4; C1<C5; C2=C3; C2<C4; C2=C5; C3<C4; C3>C5;C4>C5

[j] A1<A2; A1<A3; A1=A4; A2=A3; A2=A4; A3=A4

[k] C1A1=C2A1; C1A1=C3A1; C1A1=C4A1; C1A1=C5A1; C2A1=C3A1; C2A1=C4A1; C2A1=C5A1; C3A1=C4A1; C3A1=C5A1; C4A1=C5A1; C1A2<C2A2; C1A2<C3A2; C1A2<C4A2; C1A2<C5A2; C2A2=C3A2; C2A2=C4A2; C2A2=C5A2; C3A2=C4A2; C4A2=C5A2; C3A2=C5A2; C1A3=C2A3; C1A3=C3A3; C1A3<C4A3; C1A3=C5A3; C2A3=C3A3; C2A3=C4A3; C2A3=C5A3; C3A3=C4A3; C3A3=C5A3; C4A3>C5A3; C1A4=C2A4; C1A4=C3A4; C1A4=C4A4; C1A4=C5A4; C2A4=C3A4; C2A4=C4A4; C2A4=C5A4; C3A4=C4A4; C3A4=C5A4; C4A4=C5A4

[l] A1=A2; A1=A3; A1=A4; A2=A3; A2=A4; A3>A4

discrepancy scores related to the CFV performance. Differences were present among the means of the scores in the four sections of trials. The extant relationships were these. The mean of the third section was larger than that of the fourth section; in all of the other comparisons, the means were equivalent.

The remainder of the evidence indicates that no differences were evident among the means of the scores subdivided according to levels, orientation, type-frequency, trials, or any combination of these.

Direction of Goal Changes After Success and Failure

The relationships among the numbers of times that the subjects raised, lowered, or did not change their goals after success and failure information about their performance on the CFV are reflected by the data listed in Table 88. Only three differences, and these were on trial 13, occurred. Here, the B2D1C4 group of subjects lowered their goals after failure less often than did the B1D2C3, the B3D1C2, and the B3D1C4 groups. On the whole, the subjects responded in a similar fashion: they tended to raise their goals after success and lower them after failure.

Concept Formation Non-Verbal Task

The figures related to the subjects' learning performance and level of aspiration responses on the CFN are located in Tables 89 through 102. Tables 89, 90, and 91 consist of data relevant to the attainment time scores; Tables 92, 93, and 94, to the absolute goal discrepancy scores; Tables 95, 96, and 97, to the positive goal discrepancy scores; and Tables 98, 99, and 100, to the negative goal discrepancy scores. The summary of the results of the analyses is in Table 101. In Table 102 are data relevant to the directions in which the subjects changed their goals after they received success or failure information.

Learning Performance

Attainment Time

The variability of the subjects' attainment time scores for the CFN is reflected by the statistics listed in Table 89 and Column 2 of Table 101. Extreme heterogeneity of variance was present in the scores when they were classified over the total group of subjects according to the four categories: levels, orientation, type-frequency, and trials. Within the retarded group, there was

TABLE 88

COMPARISON OF THE GROUPS IN TERMS OF DIRECTIONS OF GOAL CHANGE AFTER SUCCESS AND FAILURE: CONCEPT FORMATION VERBAL TASK (FREQUENCIES)

Comparison	Trial 9				Trial 10				Trial 17				Trial 18			
	Direction				Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	8	0	0	8	7	0	1	8	8	0	0	8	8	0	0	8
B1D1C2	7	0	1	8	7	0	1	8	7	0	1	8	7	0	1	8
B1D1C5	6	0	1	7	2	0	0	2	2	0	0	2	2	0	1	3
B1D2C1	8	0	0	8	7	1	0	8	6	2	0	8	8	0	0	8
B1D2C2	8	0	0	8	7	0	1	8	7	0	1	8	8	0	0	8
B1D2C5	4	1	0	5	3	0	0	3	2	0	2	4	2	1	2	5
B2D1C1	7	0	1	8	8	0	0	8	7	0	1	8	7	1	0	8
B2D1C2	8	0	0	8	8	0	0	8	8	0	0	8	6	0	2	8
B2D1C5	4	1	1	6	3	1	2	6	4	0	2	6	1	0	1	2
B2D2C1	7	0	1	8	6	1	1	8	7	0	1	8	7	0	1	8
B2D2C2	7	0	1	8	8	0	0	8	7	0	1	8	8	0	0	8
B2D2C5	6	0	0	6	5	1	1	7	3	0	1	4	1	1	2	4
B3D1C1	7	0	1	8	8	0	0	8	7	0	1	8	6	1	1	8
B3D1C2	6	0	2	8	8	0	0	8	7	0	1	8	7	0	1	8
B3D1C5	5	0	2	7	2	3	1	6	0	0	1	1	2	1	3	6
B3D2C1	7	0	1	8	8	0	0	8	7	1	0	8	8	0	0	8
B3D2C2	6	1	1	8	6	1	1	8	7	1	0	8	6	0	2	8
B3D2C5	2	0	1	3	5	0	0	5	3	1	0	4	3	1	1	5
	Trial 9				Trial 10				Trial 17				Trial 18			
	Direction				Direction				Direction				Direction			
	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T
B1D1C3	1	6	1	8	1	6	1	8	2	5	1	8	1	5	2	8
B1D1C4	0	7	1	8	2	5	1	8	2	5	1	8	2	5	1	8
B1D1C5	0	0	1	1	0	5	1	6	1	2	3	6	0	4	1	5
B1D2C3	0	6	2	8	2	4	2	8	0	6	2	8	0	6	2	8
B1D2C4	1	4	3	8	0	7	1	8	2	5	1	8	1	6	1	8
B1D2C5	0	1	2	3	0	4	1	5	0	2	2	4	0	1	2	3
B2D1C3	0	8	0	8	0	8	0	8	1	7	0	8	1	7	0	8
B2D1C4	1	3	4	8	1	5	2	8	2	2	4	8	1	4	3	8
B2D1C5	0	2	0	2	1	0	1	2	0	2	1	3	2	2	2	6
B2D2C3	0	6	2	8	0	6	2	8	0	6	2	8	1	5	2	8
B2D2C4	1	5	2	8	0	6	2	8	1	5	2	8	0	5	3	8
B2D2C5	0	2	0	2	0	1	0	1	1	3	0	4	0	4	0	4
B3D1C3	0	6	2	8	1	5	2	8	0	5	3	8	1	5	2	8
B3D1C4	1	6	1	8	1	6	1	8	0	7	1	8	0	7	1	8
B3D1C5	0	0	1	1	0	1	1	2	0	3	4	7	0	2	0	2
B3D2C3	0	7	1	8	0	6	2	8	0	5	3	8	0	7	1	8
B3D2C4	1	7	0	8	0	6	2	8	0	6	2	8	1	5	2	8
B3D2C5	0	4	1	5	0	2	1	3	0	2	2	4	1	0	2	3

TABLE 88--Continued

Comparison	Trial 11				Trial 14				Trial 15				Trial 19			
	Direction				Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	8	0	0	8	8	0	0	8	7	1	0	8	8	0	0	8
B1D1C2	7	0	1	8	7	1	0	8	6	1	1	8	4	2	2	8
B1D1C3	8	0	0	8	8	0	0	8	8	0	0	8	8	0	0	8
B1D1C5	3	0	0	3	4	0	0	4	3	0	0	3	4	0	0	4
B1D2C1	8	0	0	8	8	0	0	8	8	0	0	8	7	1	0	8
B1D2C2	8	0	0	8	8	0	0	8	7	0	1	8	8	0	0	8
B1D2C3	7	0	1	8	6	1	1	8	7	0	1	8	6	0	2	8
B1D2C5	0	1	1	2	4	0	1	5	1	0	1	2	2	1	2	5
B2D1C1	8	0	0	8	7	0	1	8	8	0	0	8	7	0	1	8
B2D1C2	8	0	0	8	8	0	0	8	7	0	1	8	7	0	1	8
B2D1C3	8	0	0	8	6	1	1	8	7	1	0	8	6	1	1	8
B2D1C5	2	0	1	3	4	0	2	6	3	1	2	6	2	0	0	2
B2D2C1	7	1	0	8	7	0	1	8	6	0	2	8	6	0	2	8
B2D2C2	8	0	0	8	7	0	1	8	8	0	0	8	8	0	0	8
B2D2C3	8	0	0	8	8	0	0	8	8	0	0	8	8	0	0	8
B2D2C5	4	0	1	5	4	0	1	5	3	0	0	3	2	0	1	3
B3D1C1	7	0	1	8	8	0	0	8	8	0	0	8	8	0	0	8
B3D1C2	5	2	1	8	5	0	3	8	8	0	0	8	6	0	2	8
B3D1C3	7	0	1	8	8	0	0	8	8	0	0	8	7	0	1	8
B3D1C5	3	0	3	6	2	0	4	6	4	0	1	5	2	1	2	5
B3D2C1	6	1	1	8	7	1	0	8	8	0	0	8	8	0	0	8
B3D2C2	6	1	1	8	6	1	1	8	7	0	1	8	6	1	1	8
B3D2C3	8	0	0	8	8	0	0	8	7	0	1	8	6	1	1	8
B3D2C5	2	1	1	4	3	0	1	4	3	0	0	3	3	0	0	3
	Trial 12				Trial 13				Trial 16				Trial 20			
	Direction				Direction				Direction				Direction			
	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T
B1D1C2	0	5	3	8	0	5	3	8	1	6	1	8	1	5	2	8
B1D1C3	0	6	2	8	2	6	0	8	0	6	2	8	1	5	2	8
B1D1C4	2	5	1	8	2	4	2	8	1	5	2	8	0	6	2	8
B1D1C5	0	2	3	5	0	4	1	5	0	1	1	2	0	1	1	2
B1D2C2	0	7	1	8	0	8[a]	0	8	0	7	1	8	0	6	2	8
B1D2C3	0	6	2	8	0	6	2	8	0	6	2	8	0	5	3	8
B1D2C4	0	7	1	8	1	6	1	8	0	8	0	8	1	7	0	8
B1D2C5	0	3	1	4	0	2	1	3	0	2	1	3	1	0	1	2
B2D1C2	1	6	1	8	0	4	4	8	0	4	4	8	0	6	2	8
B2D1C3	1	7	0	8	0	7	1	8	2	6	0	8	1	7	0	8
B2D1C4	1	3	4	8	2	1[a]	5	8	2	3	3	8	1	4	3	8
B2D1C5	0	3	2	5	0	2	1	3	1	2	1	4	2	2	1	5
B2D2C2	0	6	2	8	0	5	3	8	0	5	3	8	0	4	4	8
B2D2C3	0	7	1	8	0	6	2	8	1	6	1	8	0	6	2	8
B2D2C4	0	8	0	8	0	7	1	8	0	7	1	8	0	5	3	8
B2D2C5	0	2	0	2	0	2	1	3	0	0	1	1	0	1	1	2
B3D1C2	0	7	1	8	0	8[a]	0	8	1	6	1	8	1	6	1	8
B3D1C3	0	7	1	8	0	6	2	8	1	6	1	8	0	6	2	8
B3D1C4	1	7	0	8	0	8[a]	0	8	1	7	0	8	1	5	2	8
B3D1C5	0	4	0	4	0	2	1	3	0	1	1	2	0	2	0	2
B3D2C2	1	7	0	8	2	6	0	8	1	7	0	8	1	6	1	8
B3D2C3	0	7	1	8	0	6	2	8	0	8	0	8	0	8	0	8
B3D2C4	0	6	2	8	1	4	3	8	0	5	3	8	0	5	3	8
B3D2C5	2	2	1	5	0	4	1	5	2	1	0	3	1	3	0	4

TABLE 88--Continued

Comparison	Trial 21				Trial 22				Trial 23			
	Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	8	0	0	8	8	0	0	8	8	0	0	8
B1D1C2	6	0	2	8	7	0	1	8	7	0	1	8
B1D1C3	7	0	1	8	7	0	1	8	7	1	0	8
B1D1C4	8	0	0	8	8	0	0	8	8	0	0	8
B1D1C5	2	0	1	3	1	0	0	1	5	0	0	5
B1D2C1	8	0	0	8	8	0	0	8	8	0	0	8
B1D2C2	8	0	0	8	7	0	1	8	8	0	0	8
B1D2C3	8	0	0	8	8	0	0	8	8	0	0	8
B1D2C4	7	0	1	8	8	0	0	8	7	1	0	8
B1D2C5	4	0	1	5	2	2	1	5	2	0	2	4
B2D1C1	4	0	4	8	7	0	1	8	7	1	0	8
B2D1C2	8	0	0	8	7	1	0	8	7	0	1	8
B2D1C3	7	1	0	8	6	1	1	8	8	0	0	8
B2D1C4	6	0	2	8	7	0	1	8	7	0	1	8
B2D1C5	3	0	2	5	2	0	0	2	2	0	3	5
B2D2C1	7	0	1	8	6	0	2	8	8	0	0	8
B2D2C2	8	0	0	8	8	0	0	8	8	0	0	8
B2D2C3	7	0	1	8	8	0	0	8	8	0	0	8
B2D2C4	6	0	2	8	6	0	2	8	7	0	1	8
B2D2C5	3	1	2	6	3	1	1	5	3	1	1	5
B3D1C1	8	0	0	8	8	0	0	8	8	0	0	8
B3D1C2	6	1	1	8	7	0	1	8	7	0	1	8
B3D1C3	7	0	1	8	6	0	2	8	7	0	1	8
B3D1C4	8	0	0	8	8	0	0	8	8	0	0	8
B3D1C5	4	0	2	6	3	0	1	4	1	1	3	5
B3D2C1	8	0	0	8	7	1	0	8	8	0	0	8
B3D2C2	4	1	3	8	6	2	0	8	7	0	1	8
B3D2C3	6	1	1	8	7	1	0	8	7	1	0	8
B3D2C4	6	0	2	8	7	0	1	8	8	0	0	8
B3D2C5	2	0	1	3	1	1	0	2	3	0	0	3

[a] Trial 13, FL: B2D1C4 < B1D2C2, B3D1C2, and B3D1C4.

TABLE 89

COMPARISON OF THE GROUPS IN TERMS OF ATTAINMENT TIME: CONCEPT FORMATION NON-VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
						B1			B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	383	1,018	12.739***							
	B2		383	928								
	B3		383	1,316								
D	D1	1	575	930	20.612***	191	904	2.106	721	9.790**	941	16.343***
	D2		575	1,360		191	1,116		1,136		1,697	
C	C1	5	191	1,181	23.668***	63	835	14.558	712	14.488	1,768	25.726***
	C2		191	1,363		63	819		1,013		1,928	
	C3		191	799		63	729		657		867	
	C4		191	1,414		63	936		1,476		1,601	
	C5		191	1,211		63	1,637		902		1,018	
	C6		191	909		63	1,127		776		716	
A	A1	3	287	1,143	12.412**	95	1,120	31.475***	992	5.467	1,312	1.235
	A2		287	781		95	490		657		1,062	
	A3		287	855		95	392		670		1,190	
	A4		287	1,011		95	567		825		1,275	

** $p < .01$

*** $p < .001$

heterogeneity among the scores in the four sections of trials and homogeneity among the scores in the treatments categories. Within the normal group, heterogeneity occurred between the scores in the two orientation groups but not among the scores in the six type-frequency groups and in the four sections of trials. Within the superior group, extreme heterogeneity was present among the scores in the orientation and type-frequency classifications but not among the scores categorized in terms of sections of trials.

Tables 90 and 91 and Column 7 of Table 101 all are composed of data relevant to the subjects' mean attainment times on the CFN. Differences were present among the means of several sections of trials. The mean of the first section was greater than those of the second, third, and fourth sections; the mean of the second section was greater than those of the third and fourth sections; however, the mean of the third section was equivalent to that of the fourth section.

The means of the three intelligence groups differed also. The retarded group had a lower mean than the normal and superior groups and the normal group had a lower mean than the superior group.

There were differences, furthermore, among the means of the cells formed by the combination of the levels and trial factors. These relationships were apparent. On the first section of trials, the means in each comparison were equivalent. On the second and third sections of trials, the means of the retarded group were lower than those of both the normal and superior groups. The means of these latter groups did not differ. On the fourth section of trials, the mean of the retarded group was lower than those of the normal and superior groups and the mean of the normal group was lower than that of the superior group.

In no other comparisons than those cited were there differences apparent.

Level of Aspiration Responses

Absolute Goal Discrepancy Scores

The statistics pertaining to the variability of the subjects' absolute goal discrepancy scores associated with CFN performance are located in Table 92 and Column 3 of Table 101. Heterogeneity of variance was present in the subjects' scores in all classifications both over the total group of subjects and within each of the three intelligence groups.

Tables 93 and 94 and Column 8 of Table 101 contain information about the subjects' absolute goal discrepancy scores for CFN performance. Here, the null relationship was extant throughout: no differences existed among the means of the subjects' scores when they were classified accordingly to levels, treatments, trials, or any combination of these.

TABLE 90

DESCRIPTION OF THE GROUPS IN TERMS OF ATTAINMENT TIME: CONCEPT FORMATION NON-VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	103	74	59	54	111	88	80	83	125	97	88	87
		C2	117	81	67	60	117	94	81	81	124	105	101	96
		C3	108	78	63	63	104	90	75	73	116	92	92	88
		C4	102	77	64	57	113	98	88	82	117	98	90	82
		C5	127	71	56	52	110	85	76	68	109	85	84	86
		C6	106	79	65	61	104	96	96	94	110	99	89	89
	D2	C1	114	80	66	66	107	89	77	70	119	95	95	93
		C2	94	74	75	59	94	76	69	73	120	102	92	89
		C3	90	78	68	66	120	92	80	74	120	92	80	78
		C4	113	83	75	71	119	95	84	80	117	109	107	104
		C5	147	98	77	84	104	79	78	79	124	101	98	108
		C6	123	80	65	63	112	91	84	89	101	85	80	86

TABLE 91

COMPARISON OF THE GROUPS IN TERMS OF ATTAINMENT TIME: CONCEPT FORMATION NON-VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	287	109,136.22		
B	2	8,515.43	4,257.72	11.35***
D	1	114.88	114.88	-
C	5	530.85	106.17	-
BD	2	541.19	270.60	-
BC	10	1,978.11	197.81	-
DC	5	2,020.51	404.10	1.08
BDC	10	870.93	87.09	-
Error (b)	252	94,564.32	375.26	
Within Subjects	864	55,577.53		
A	3	28,732.50	9,577.50	337.00***
BA	6	2,177.59	362.93	12.77***
DA	3	70.55	23.52	-
CA	15	591.36	39.42	1.39
BDA	6	89.35	14.89	-
BCA	30	1,318.45	43.95	1.55
DCA	15	350.09	23.34	-
BDCA	30	764.09	25.47	-
Error (w)	756	21,483.55	28.42	
Total	1,151	164,713.75		

TABLE 91--Continued

B. INDIVIDUAL COMPARISONS

Comparison							
B	$\overline{X}$	B1:80.27	B2:89.62	B3:100.92			
	Group	B1 < B2	B1 < B3	B2 < B3			
	Diff.	9.35	20.65	11.30			
	t	4.156***	8.350***	4.669***			
A	$\overline{X}$	A1:112.81	A2:88.50	A3:79.56	A4:80.22		
	Group	A1 > A4	A1 > A3	A1 > A4	A2 > A3	A2 > A4	A3= A4
	Diff.	24.31	33.25	32.59	8.94	8.28	0.66
	t	9.422***	12.643***	11.938***	3.756***	3.325**	0.259
BA	$\overline{X}$	B1A1:112.00	B2A1:109.58	B3A1:116.83	B1A2:79.42		
	Group	B1A[illegible] = B2A1	B1A1 = B3A1	B2A1 = B3A1	B1A2 < B2A2		
	Diff.	2.42	4.83	7.25	9.98		
	t	0.513	0.955	1.472	2.873**		
	$\overline{X}$	B2A2:89.42	B3A2:96.67	B1A3:66.67	B2A3:80.67		
	Group	B1A2 < B3A2	B2A2 = B3A2	B1A3 < B2A3	B1A3 < B3A3		
	Diff.	17.25	7.25	14.00	24.66		
	t	4.269***	1.705	4.187***	6.045***		
	$\overline{X}$	B3A3:91,33	B1A4:63.00	B2A4:78.83	B3A4:98.83		
	Group	B2A3 = B3A3	B1A4 < B2A4	B1A4 < B3A4	B2A4 < B3A4		
	Diff.	10.66	15.83	35.83	20.00		
	t	2.409	4.136***	8.137***	3.529***		

$^{**}p < .01$

$^{***}p < .001$

TABLE 92

COMPARISON OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: CONCEPT FORMATION NON-VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	319	95	44.739***							
	B2		319	47								
	B3		319	57								
D	D1	1	479	44	57.793***	159	58	25.486***	60	12.293***	13	141.029***
	D2		479	88		159	131		34		99	
C	C1	4	191	33	303.958***	63	70	110.331***	13	87.666***	14	224.816***
	C2		191	12		63	10		20		6	
	C3		191	44		63	92		30		12	
	C4		191	101		63	99		103		104	
	C5		191	136		63	202		68		142	
A	A1	3	239	122	111.843***	79	247	115.710***	45	36.071***	69	47.719***
	A2		239	55		79	40		24		101	
	A3		239	55		79	55		86		25	
	A4		239	32		79	32		33		33	

***$p < .001$

TABLE 93

DESCRIPTION OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: CONCEPT FORMATION NON-VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	6	4	4	4	3	4	4	4	6	3	5	5
		C2	3	3	4	3	4	4	3	3	2	3	2	2
		C3	13	4	3	2	3	3	3	4	6	4	4	4
		C4	13	4	5	3	3	5	14	8	3	3	6	3
		C5	3	5	4	4	3	10	7	6	3	4	4	4
	D2	C1	13	4	5	4	6	4	4	4	4	4	4	4
		C2	4	4	4	4	8	4	5	4	3	4	4	5
		C3	6	6	3	5	8	4	6	6	4	4	3	4
		C4	3	8	14	4	6	3	5	2	16	4	8	8
		C5	20	10	4	10	6	4	7	6	4	15	8	7

TABLE 94

COMPARISON OF THE GROUPS IN TERMS OF ABSOLUTE GOAL DISCREPANCY SCORES: CONCEPT FORMATION NON-VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	3,438.48		
B	2	21.56	10.78	-
D	1	57.62	57.62	4.03
C	4	140.93	35.23	2.46
BD	2	20.53	10.27	-
BC	8	14.96	1.87	-
DC	4	41.52	10.38	-
BDC	8	135.42	16.93	1.18
Error (b)	210	3,005.94	14.31	
Within Subjects	720	4,495.47		
A	3	49.72	16.57	2.74
BA	6	53.24	8.87	1.47
DA	3	16.38	5.46	-
CA	12	101.58	8.47	1.40
BDA	6	31.99	5.33	-
BCA	24	116.07	4.84	-
DCA	12	33.19	2.77	-
BDCA	24	282.90	11.79	1.95
Error (w)	630	3,810.40	6.05	
Total	959	7,933.95		

Positive Goal Discrepancy Scores

In Table 95 and Column 4 of Table 101 are data relevant to the variability of the subjects' positive goal discrepancy scores related to CFN performance. Here, as in the case with the absolute goal discrepancy scores, extreme differences in variability were present among the subjects' scores in the several categories both over the total group of subjects and within each of the three intelligence groups.

The relationships among the subjects' mean positive goal discrepancy scores for CFN performance are reflected in the evidence included in Tables 96 and 97 and Column 9 of Table 101. Consistency with the absolute goal discrepancy scores again may be noted; viz, no differences occurred among the scores of the subjects when they were classified according to levels, treatments, trials, or any combination of these.

Negative Goal Discrepancy Scores

The variability of the negative goal discrepancy scores related to CFN performance is indicated by the data listed in Table 98 and Column 5 of Table 101. Over the total group of subjects, homogeneity existed when the scores of the subjects in the three intelligence groups were compared; conversely, heterogeneity was evident when the scores were classified according to orientation, type-frequency, and trials. Further, this same pattern of relationships, heterogeneity of variance associated with treatments and sections of trials, was evident within each of the three intelligence groups.

Finally, data pertinent to the relationships among the mean negative goal discrepancy scores for the CFN are included in Tables 99 and 100 and Column 10 of Table 101. The probability of the F-ratio yielded by the analysis of differences among the four sections of trials is less than .01 but greater than .001. However, the probability of the chi square yielded by the corresponding analysis of inter-individual variability is less than .001. Consequently, this F-ratio cannot be considered to occur at a probability level sufficiently small to satisfy the criterion for rejection of the null hypothesis in cases such as these. The null relationship obtained in the remaining comparisons; i.e., no differences were present among the means of the subjects' negative goal discrepancy scores when they were classified according to levels, treatments, any combination of these, or any combination of these with trials.

TABLE 95

COMPARISON OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: CONCEPT FORMATION NON-VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
						B1			B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	319	86	37.693***							
	B2		319	57								
	B3		319	43								
D	D1	1	479	52	13.008***	159	62	12.834***	79	24.739***	15	85.677***
	D2		479	72		159	110		35		71	
C	C1	4	191	36	270.521***	63	74	113.492***	15	104.397***	18	204.558***
	C2		191	12		63	13		17		5	
	C3		191	52		63	96		47		14	
	C4		191	66		63	37		137		26	
	C5		191	140		63	204		70		148	
A	A1	3	239	113	131.552***	79	257	203.593***	40	46.762***	35	93.221***
	A2		239	55		79	29		32		104	
	A3		239	25		79	13		40		21	
	A4		239	56		79	37		118		14	

***$p < .001$

TABLE 96

DESCRIPTION OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: CONCEPT FORMATION NON-VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	5	3	4	4	3	2	3	3	5	2	3	3
		C2	2	2	4	3	4	3	2	2	1	2	2	2
		C3	12	3	4	2	2	4	3	2	6	2	3	2
		C4	12	3	4	2	0	5	3	12	3	3	7	2
		C5	3	5	4	4	2	8	6	4	1	4	5	3
	D2	C1	12	4	4	2	4	3	3	4	2	2	2	1
		C2	3	4	4	5	4	3	2	2	2	3	3	3
		C3	4	6	3	5	6	4	5	6	3	4	2	1
		C4	2	4	2	1	3	3	3	2	8	3	4	2
		C5	19	8	4	9	5	3	7	2	4	15	8	7

TABLE 97

COMPARISON OF THE GROUPS IN TERMS OF POSITIVE GOAL DISCREPANCY SCORES: CONCEPT FORMATION NON-VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	3,112.83		
B	2	35.54	17.77	1.36
D	1	11.43	11.43	-
C	4	124.04	31.01	2.37
BD	2	4.72	2.36	-
BC	8	27.10	3.39	-
DC	4	74.76	18.69	1.43
BDC	8	90.91	11.36	-
Error (b)	210	2,744.33	13.07	
Within Subjects	720	4,333.25		
A	3	26.28	8.76	1.47
BA	6	78.20	13.03	2.18
DA	3	9.43	3.14	-
CA	12	41.83	3.49	-
BDA	6	39.97	6.66	1.12
BCA	24	137.91	5.75	-
DCA	12	43.42	3.62	-
BDCA	24	194.31	8.10	1.36
Error (w)	630	3,761.90	5.97	
Total	959	7,446.08		

TABLE 98

COMPARISON OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: CONCEPT FORMATION NON-VERBAL TASK (VARIANCES, ROUNDED)

Comparison	Group	Between Groups				Within Groups: B1, B2, B3						
							B1		B2		B3	
		df	N-1	S^2	χ^2	N-1	S^2	χ^2	S^2	χ^2	S^2	χ^2
B	B1	2	319	32	4.752							
	B2		319	32								
	B3		319	26								
D	D1	1	479	19	60.030***	159	8	124.763***	43	19.303***	6	141.693***
	D2		479	40		159	55		21		45	
C	C1	4	191	10	465.243***	63	20	188.280***	4	169.746***	5	233.029***
	C2		191	9		63	4		13		11	
	C3		191	9		63	6		13		8	
	C4		191	96		63	94		97		99	
	C5		191	24		63	34		32		7	
A	A1	3	239	23	79.498***	79	6	150.752***	18	81.657***	46	67.722***
	A2		239	24		79	51		15		7	
	A3		239	52		79	61		77		20	
	A4		239	19		79	8		18		31	

***$p < .001$

TABLE 99

DESCRIPTION OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: CONCEPT FORMATION NON-VERBAL TASK (MEANS, ROUNDED)

		Level	B1				B2				B3			
		Trial	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Condition	D1	C1	1	4	2	2	0	2	2	1	0	2	2	2
		C2	0	2	2	1	0	2	2	2	1	2	2	1
		C3	2	2	2	1	2	3	4	3	1	2	3	3
		C4	1	2	2	2	3	4	12	4	0	1	2	1
		C5	0	2	0	0	1	6	2	3	2	2	2	1
	D2	C1	1	3	4	3	2	1	1	0	2	2	2	2
		C2	1	1	3	2	4	3	3	3	2	3	3	2
		C3	2	1	1	1	2	3	5	3	1	3	4	4
		C4	1	7	12	4	3	1	2	2	8	3	4	7
		C5	1	9	2	1	2	2	2	5	1	2	3	3

TABLE 100

COMPARISON OF THE GROUPS IN TERMS OF NEGATIVE GOAL DISCREPANCY SCORES: CONCEPT FORMATION NON-VERBAL TASK (MEANS)

A. OVER-ALL COMPARISONS

Source	df	SS	MS	F
Between Subjects	239	1,789.27		
B	2	3.62	1.81	–
D	1	19.80	19.80	2.63
C	4	48.54	12.14	1.61
BD	2	22.04	11.02	1.47
BC	8	26.95	3.37	–
DC	4	9.26	2.32	–
BDC	8	78.89	9.86	1.31
Error (b)	210	1,580.17	7.52	
Within Subjects	720	1,803.13		
A	3	38.06	12.69	5.18**
BA	6	14.16	2.36	–
DA	3	3.06	1.02	–
CA	12	41.92	3.49	1.42
BDA	6	19.16	3.19	1.30
BCA	24	51.04	2.13	–
DCA	12	6.63	0.55	–
BDCA	24	83.22	3.47	1.42
Error (w)	630	1,545.88	2.45	
Total	959	3,592.40		

**$p < .01$

TABLE 101

SUMMARY OF THE RESULTS OF THE COMPARISONS OF THE GROUPS IN TERMS OF THE RESPONSE MEASURES RELATED TO THE CONCEPT FORMATION NON-VERBAL TASK

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			χ^2					F			
Response Measure			Att.	G.D. Ab.	G.D+	G.D-	Comparison	Att.	G.D. Ab.	G.D+	G.D-
Table			89	92	95	98		91	94	97	100
Comparison		B	.01	.001	.001	N.S.	B	.001[a]	N.S.	N.S.	N.S.
		D	.001	.001	.001	.001	D	N.S.	N.S.	N.S.	N.S.
		C	.001	.001	.001	.001	C	N.S.	N.S.	N.S.	N.S.
		A	.01	.001	.001	.001	A	.001[b]	N.S.	N.S.	.01[d]
	B1	D	N.S.	.001	.001	.001	BD	N.S.	N.S.	N.S.	N.S.
		C	N.S.	.001	.001	.001	BC	N.S.	N.S.	N.S.	N.S.
		A	.001	.001	.001	.001	DC	N.S.	N.S.	N.S.	N.S.
							BDC	N.S.	N.S.	N.S.	N.S.
	B2	D	.01	.001	.001	.001	BA	.001[c]	N.S.	N.S.	N.S.
		C	N.S.	.001	.001	.001	DA	N.S.	N.S.	N.S.	N.S.
		A	N.S.	.001	.001	.001	CA	N.S.	N.S.	N.S.	N.S.
							BDA	N.S.	N.S.	N.S.	N.S.
	B3	D	.001	.001	.001	.001	BCA	N.S.	N.S.	N.S.	N.S.
		C	.001	.001	.001	.001	DCA	N.S.	N.S.	N.S.	N.S.
		A	N.S.	.001	.001	.001	BDCA	N.S.	N.S.	N.S.	N.S.

[a] B1<B2; B1<B3; B2<B3

[b] A1>A2; A1>A3; A1>A4; A2>A3; A2>A4; A3=A4

[c] B1A1=B2A1; B1A1=B3A1; B2A1=B3A1; B1A2<B2A2; B1A2<B3A2; B2A2=B3A2; B1A3<B2A3; B1A3<B3A3; B2A3=B3A3; B1A4<B2A4; B1A4<B3A4; B2A4<B3A4

[d] N.B.: Corresponding χ^2 occurs at $p < .001$

Direction of Goal Changes After Success and Failure

In Table 102 is information pertinent to the frequencies with which subjects altered their goals in the several directions after success or failure information was administered to them as they responded to the CFN. No differences occurred among the groups in any of the comparisons performed. Thus, here again, the subjects responded in a similar fashion insofar as direction of goal change is concerned. In general, they tended to raise their goals after success and lower them after failure.

Stanford-Binet Test of Intelligence

The material contained in Tables 103 and 104 and Appendix J is relevant to the analyses of the responses of the subjects to the several items included in the 1937 Revision of the Stanford-Binet Test of Intelligence, Form L. The information in Table 103 and Appendix J pertains to the subject characteristics. Inclusion of this information is necessary because the samples employed in this phase of the study differed, to some extent, from those employed in the other phases. That is, in order to control the subjects more precisely in terms of mental age and range of subtests administered, it was necessary to utilize only 60 subjects from each of the total groups of 96 subjects. Table 104 is composed of data pertinent to the relative frequencies with which the subjects passed or failed the several subtests.

Subjects

Listed in Appendix J are the code numbers of the 180 subjects whose performance was considered in these analyses. Table 103 is composed of the results of the comparisons of the subjects in terms of MA, CA, and IQ. The retarded, normal, and superior subjects were homogeneous in terms of the means and variances of their MA's. This was not the case when CA and IQ were considered. As expected, the mean CA of the retarded subjects was larger than that of the normal and superior subjects, and the mean CA of the normal subjects was larger than that of the superior subjects; these relationships were reversed when mean IQ was scrutinized. With two exceptions, the variances in the several IQ and CA comparisons were heterogeneous. These exceptions included the CA variances of the retarded and superior subjects and the IQ variances of the normal and superior subjects.

TABLE 102

COMPARISON OF THE GROUPS IN TERMS OF DIRECTIONS OF GOAL CHANGE AFTER SUCCESS AND FAILURE: CONCEPT FORMATION NON-VERBAL TASK (FREQUENCIES)

Comparison	Trial 3				Trial 4				Trial 11				Trial 12			
	Direction				Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	7	0	1	8	7	1	0	8	7	1	0	8	7	1	0	8
B1D1C2	7	0	1	8	8	0	0	8	7	0	1	8	8	0	0	8
B1D1C5	7	0	0	7	6	0	0	6	2	0	1	3	2	0	0	2
B1D2C1	7	1	0	8	6	2	0	8	7	1	0	8	6	2	0	8
B1D2C2	8	0	0	8	8	0	0	8	8	0	0	8	8	0	0	8
B1D2C5	5	0	0	5	4	0	0	4	3	0	0	3	0	1	0	1
B2D1C1	7	0	1	8	8	0	0	8	7	0	1	8	7	0	1	8
B2D1C2	7	0	1	8	6	0	2	8	7	0	1	8	8	0	0	8
B2D1C5	6	0	0	6	6	0	0	6	3	0	0	3	2	0	1	3
B2D2C1	8	0	0	8	8	0	0	8	8	0	0	8	8	0	0	8
B2D2C2	6	0	2	8	6	0	2	8	7	1	0	8	5	1	2	8
B2D2C5	6	0	0	6	4	0	0	4	4	0	0	4	3	1	0	4
B3D1C1	7	0	1	8	7	0	1	8	6	0	2	8	6	0	2	8
B3D1C2	8	0	0	8	7	1	0	8	7	1	0	8	7	0	1	8
B3D1C5	6	0	0	6	3	0	0	3	5	0	0	5	3	0	0	3
B3D2C1	6	1	1	8	7	0	1	8	8	0	0	8	8	0	0	8
B3D2C2	7	0	1	8	7	0	1	8	6	1	1	8	7	0	1	8
B3D2C5	4	0	0	4	5	0	0	5	5	0	0	5	2	0	0	2
	Trial 3				Trial 4				Trial 11				Trial 12			
	Direction				Direction				Direction				Direction			
	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T
B1D1C3	0	7	1	8	0	6	2	8	0	6	2	8	0	6	2	8
B1D1C4	1	6	1	8	1	7	0	8	0	5	3	8	0	6	2	8
B1D1C5	0	0	1	1	0	2	0	2	0	5	0	5	1	4	1	6
B1D2C3	1	6	1	8	2	5	1	8	1	4	3	8	0	5	3	8
B1D2C4	1	6	1	8	1	5	2	8	0	6	2	8	0	6	2	8
B1D2C5	1	2	0	3	0	3	1	4	1	2	2	5	1	5	1	7
B2D1C3	0	8	0	8	1	7	0	8	0	7	1	8	0	7	1	8
B2D1C4	0	6	2	8	0	7	1	8	1	5	2	8	0	8	0	8
B2D1C5	0	1	1	2	1	0	1	2	0	4	1	5	0	5	0	5
B2D2C3	0	7	1	8	1	6	1	8	0	7	1	8	2	6	0	8
B2D2C4	0	5	3	8	0	6	2	8	0	6	2	8	0	6	2	8
B2D2C5	1	1	0	2	1	2	1	4	0	4	0	4	2	2	0	4
B3D1C3	0	6	2	8	0	7	1	8	2	4	2	8	0	6	2	8
B3D1C4	0	6	2	8	0	8	0	8	1	5	2	8	0	6	2	8
B3D1C5	0	2	0	2	1	4	0	5	0	2	1	3	0	5	0	5
B3D2C3	0	4	4	8	0	7	1	8	0	5	3	8	0	7	1	8
B3D2C4	1	7	0	8	0	8	0	8	3	3	2	8	1	7	0	8
B3D2C5	0	2	2	4	0	3	0	3	1	2	0	3	1	5	0	6

TABLE 102--Continued

Comparison	Trial 5				Trial 8				Trial 9				Trial 11			
	Direction				Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	7	1	0	8	6	1	1	8	7	1	0	8	7	1	0	8
B1D1C2	8	0	0	8	6	0	2	8	8	0	0	8	7	0	1	8
B1D1C3	6	0	2	8	7	0	1	8	6	0	2	8	8	0	0	8
B1D1C5	4	0	0	4	6	0	0	6	2	0	0	2	2	0	0	2
B1D2C1	7	0	1	8	6	2	0	8	6	2	0	8	6	2	0	8
B1D2C2	8	0	0	8	8	0	0	8	7	0	1	8	8	0	0	8
B1D2C3	8	0	0	8	8	0	0	8	8	0	0	8	8	0	0	8
B1D2C5	6	0	0	6	4	0	1	5	4	0	0	4	6	0	0	6
B2D1C1	8	0	0	8	6	2	0	8	8	0	0	0	5	0	3	8
B2D1C2	8	0	0	8	8	0	0	8	6	0	2	8	7	0	1	8
B2D1C3	6	0	2	8	7	0	1	8	8	0	0	8	6	0	2	8
B2D1C5	6	0	0	6	6	0	0	6	4	0	1	5	5	0	0	5
B2D2C1	7	0	1	8	7	0	1	8	8	0	0	8	8	0	0	8
B2D2C2	6	0	2	8	4	2	2	8	5	0	3	8	6	1	1	8
B2D2C3	6	1	1	8	7	0	1	8	6	1	1	8	4	1	3	8
B2D2C5	5	0	0	5	7	0	0	7	5	0	0	5	2	0	0	2
B3D1C1	7	0	1	8	6	0	2	8	6	0	2	8	6	0	2	8
B3D1C2	7	1	0	8	7	1	0	8	7	0	1	8	7	0	1	8
B3D1C3	7	1	0	8	7	1	0	8	6	2	0	8	7	0	1	8
B3D1C5	8	0	0	8	6	0	0	6	2	1	0	3	5	1	2	8
B3D2C1	6	1	1	8	8	0	0	8	8	0	0	8	7	0	1	8
B3D2C2	7	0	1	8	7	0	1	8	8	0	0	8	7	0	1	8
B3D2C3	5	1	2	8	6	0	2	8	5	1	2	8	6	0	2	8
B3D2C5	5	0	0	5	4	0	0	4	4	0	0	4	7	0	0	7
	Trial 6				Trial 7				Trial 10				Trial 14			
	Direction				Direction				Direction				Direction			
	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T	FR	FL	FNC	T
B1D1C2	1	6	1	8	0	7	1	8	3	3	2	8	0	5	3	8
B1D1C3	0	6	2	8	0	6	2	8	0	7	1	8	0	5	3	8
B1D1C4	1	6	1	8	2	5	1	8	1	4	3	8	0	6	2	8
B1D1C5	0	3	0	3	1	3	1	5	0	2	1	3	1	3	1	5
B1D2C2	0	7	1	8	0	7	1	8	0	8	0	8	1	5	2	8
B1D2C3	1	4	3	8	1	6	1	8	0	6	2	8	0	6	2	8
B1D2C4	1	5	2	8	0	6	2	8	0	6	2	8	1	5	2	8
B1D2C5	1	4	0	5	1	0	0	1	0	4	1	5	2	3	1	6
B2D1C2	0	7	1	8	1	7	0	8	0	6	2	8	0	5	3	8
B2D1C3	0	7	1	8	0	8	0	8	1	7	0	8	0	8	0	8
B2D1C4	0	6	2	8	1	6	1	8	2	5	1	8	2	4	2	8
B2D1C5	0	1	2	3	0	2	1	3	0	3	0	3	0	2	2	4
B2D2C2	4	4	0	8	4	4	0	8	1	3	4	8	1	4	3	8
B2D2C3	1	7	0	8	1	7	0	8	2	6	0	8	0	8	0	8
B2D2C4	0	5	3	8	0	5	3	8	0	5	3	8	0	6	2	8
B2D2C5	0	5	0	5	0	4	0	4	0	3	1	4	1	2	1	4
B3D1C2	0	7	1	8	0	6	2	8	0	7	1	8	0	7	1	8
B3D1C3	0	7	1	8	0	7	1	8	0	6	2	8	0	6	2	8
B3D1C4	0	6	2	8	0	7	1	8	0	4	4	8	2	3	3	8
B3D1C5	1	2	0	3	0	4	0	4	1	2	0	3	0	4	0	4
B3D2C2	0	8	0	8	0	8	0	8	0	7	1	8	1	5	2	8
B3D2C3	1	5	2	8	0	8	0	8	0	7	1	8	0	8	0	8
B3D2C4	2	4	2	8	1	6	1	8	1	7	0	8	2	6	0	8
B3D2C5	1	3	0	4	1	2	2	5	0	4	0	4	0	4	0	4

TABLE 102--Continued

Comparison	Trial 15				Trial 16				Trial 17			
	Direction				Direction				Direction			
	SR	SL	SNC	T	SR	SL	SNC	T	SR	SL	SNC	T
B1D1C1	8	0	0	8	7	1	0	8	8	0	0	8
B1D1C2	7	0	1	8	8	0	0	8	8	0	0	8
B1D1C3	7	0	1	8	8	0	0	8	8	0	0	8
B1D1C4	7	0	1	8	8	0	0	8	7	0	1	8
B1D1C5	2	0	0	2	5	0	0	5	2	0	0	2
B1D2C1	6	1	1	8	6	2	0	8	6	1	1	8
B1D2C2	6	1	1	8	8	0	0	8	8	0	0	8
B1D2C3	7	0	1	8	8	0	0	8	8	0	0	8
B1D2C4	5	0	3	8	5	1	2	8	5	0	3	8
B1D2C5	1	0	0	1	2	0	0	2	2	0	0	2
B2D1C1	7	0	1	8	8	0	0	8	8	0	0	8
B2D1C2	8	0	0	8	7	1	0	8	8	0	0	8
B2D1C3	8	0	0	8	6	0	2	8	8	0	0	8
B2D1C4	4	3	1	8	7	1	0	8	7	1	0	8
B2D1C5	4	1	0	5	5	0	0	5	2	0	1	3
B2D2C1	8	0	0	8	8	0	0	8	8	0	0	8
B2D2C2	5	2	1	8	6	1	1	8	5	0	3	8
B2D2C3	7	0	1	8	4	2	2	8	6	1	1	8
B2D2C4	7	0	1	8	7	0	1	8	7	0	1	8
B2D2C5	2	1	0	3	5	1	0	6	4	0	0	4
B3D1C1	6	0	2	8	7	0	1	8	6	0	2	8
B3D1C2	7	0	1	8	8	0	0	8	7	1	0	8
B3D1C3	6	2	0	8	6	2	0	8	8	0	0	8
B3D1C4	6	1	1	8	7	1	0	8	6	1	1	8
B3D1C5	3	0	1	4	4	0	0	4	2	0	0	2
B3D2C1	6	1	1	8	8	0	0	8	8	0	0	8
B3D2C2	7	0	1	8	6	0	2	8	6	0	2	8
B3D2C3	6	1	1	8	5	3	0	8	6	1	1	8
B3D2C4	7	1	0	8	5	1	2	8	7	1	0	8
B3D2C5	5	0	0	5	5	0	0	5	1	0	0	1

TABLE 103

COMPARISON OF THE GROUPS IN TERMS OF MENTAL AGE, CHRONOLOGICAL AGE, AND INTELLIGENCE QUOTIENT: SAMPLES EMPLOYED IN THE ANALYSES OF PERFORMANCE ON THE SUBTESTS OF THE 1937 REVISION OF THE STANFORD-BINET TEST OF INTELLIGENCE, FORM L (MEANS, VARIANCES)

A. OVER-ALL COMPARISONS

Source		df	SS	MS	F
Mental Age	B	2	13.31	6.66	0.128
	Error (b)	177	9,238.69	52.20	
	Total	179	9,252.00		
Chronological Age	B	2	399,020.70	199,510.35	1,344.50***
	Error (b)	177	26,265.58	148.39	
	Total	179	425,286.28		
Intelligence Quotient	B	2	99,391.22	49,695.22	1,413.40***
	Error (b)	177	6,222.69	35.16	
	Total	179	105,613.91		

B. INDIVIDUAL COMPARISONS

Comparison	s^2	B1:52.71	B2:52.45	B3:51.43
Mental Age	Group	B1 = B2	B1 = B3	B2 = B3
	F	1.01	1.01	1.02
	$\bar{X}$	B1:121.78	B2:121.83	B3:122.38
	Group	B1 = B2	B1 = B3	B2 = B3
	Diff.	0.05	0.60	0.55
	t^a			
Chronological Age	s^2	B1:169.33	B2:61.59	B3:214.25
	Group	B1 > B2	B1 = B3	B2 < B3
	F	2.74***	1.27	3.46***
	$\bar{X}$	B1:179.70	B2:118.00	B3:102.82
	Group	B1 > B2	B1 > B3	B2 > B3
	Diff.	61.70	76.88	15.18
	t	31.749***	30.387***	7.093***
Intelligence Quotient	s^2	B1:13.47	B2:31.71	B3:60.29
	Group	B1 < B2	B1 < B3	B2 = B3
	F	2.41**	4.54***	1.89
	$\bar{X}$	B1:71.23	B2:105.02	B3:128.48
	Group	B1 < B2	B1 < B3	B2 < B3
	Diff.	33.79	57.25	23.46
	t	38.839***	52.045***	18.919***

[a] N.B.: Corresponding F ratio occurs at $p > .01$; therefore, no individual comparisons were warranted.

**$p < .01$

***$p < .001$

Frequencies of Success and Failure

Table 104 contains the information about the relationships among the numbers of times the subjects in the three groups passed or failed the several subtests. Differences occurred on eight subtests; comparisons were made on 62 subtests within the Year VI-0 to Average Adult range. The obtained differences may be listed as follows. Rhymes (IX-4) and Minkus completion (XII-6): for each of these subtests, the frequency of retarded subjects was smaller than that of the normal subjects but not that of the superior subjects; the frequencies of these latter groups were equivalent. Making change (IX-5): the frequency of retarded subjects was larger than that of superior subjects; the frequencies in the other two comparisons were similar. Reading and report (X-3), Finding reasons (X-4), and Similarities: three things (XI-6): for each of these subtests, the frequency of the retarded subjects was smaller than that of the superior subjects; in the other two comparisons, the frequencies did not differ. Abstract words (XI-3) and Vocabulary (XIII-1): for each of these subtests, the frequency of the retarded subjects was larger than that of the normal subjects; in the remaining two comparisons, the frequencies were homogeneous.

California Achievement Test

In Tables 105 and 106 and Appendix J appears information pertinent to the comparisons of the three groups of subjects in terms of total reading, reading comprehension, and reading vocabulary grade placement on the California Achievement Tests: Upper Primary and Elementary Batteries, Form W. Table 105 and Appendix J consist of subject data; Table 106, of achievement test data. The presentation of the subject data is necessary because there was not sufficient time to administer achievement tests to all of the subjects; consequently, the characteristics of the samples employed in this phase of the investigation differed, to some extent, from those utilized in the other phases.

Subjects

The code numbers of the 240 subjects whose responses are compared in these analyses are presented in Appendix J. The relationships among the groups in terms of subject characteristics are reflected in the data located in Table 105. According to the results of the generalized comparisons, the means of the subjects differed in terms of all three attributes--MA, CA, and IQ. Subsequent scrutiny revealed that the following differences occurred. While the retarded and normal groups were homogeneous insofar as mean MA was concerned, each group had a lower mean MA than the superior group. In the CA and IQ comparisons, the expected relationships were extant: to wit, the mean CA of the retarded subjects was larger than that of the normal and superior subjects

TABLE 104

COMPARISONS OF THE GROUPS IN TERMS OF PSYCHOMETRIC TEST PERFORMANCE: SUBTEST SUCCESSES AND FAILURES, 1937 REVISION OF THE STANFORD-BINET TEST OF INTELLIGENCE, FORM L (FREQUENCIES)

A. COMPARISONS ON ALL SUBTESTS

Subtest: Number and Name	Frequency						Significance of Ch Frequency Passing		
	B1		B2		B3		B1:B2	B1:B3	B2:B3
	P	F	P	F	P	F			
Year VI									
1. Vocabulary	60	0	60	0	60	0			
2. Copying a bead chain from memory	60	0	60	0	60	0			
3. Mutilated pictures	60	0	60	0	60	0			
4. Number concepts	60	0	60	0	60	0			
5. Pictorial likenesses and differences	60	0	60	0	60	0			
6. Maze tracing	60	0	60	0	60	0			
Year VII									
1. Picture absurdities I	60	0	60	0	60	0	N.S.	N.S.	N.S.
2. Similarities: Two things	59	1	59	1	60	0	N.S.	N.S.	N.S.
3. Copying a diamond	59	1	60	0	58	2	N.S.	N.S.	N.S.
4. Comprehension III	59	1	59	1	60	0	N.S.	N.S.	N.S.
5. Opposite analogies I	59	1	60	0	60	0	N.S.	N.S.	N.S.
6. Repeating 5 digits	58	2	58	2	56	4	N.S.	N.S.	N.S.
Year VIII									
1. Vocabulary	59	1	59	1	58	2	N.S.	N.S.	N.S.
2. Memory for stories: The Wet Fall	56	4	58	2	57	3	N.S.	N.S.	N.S.
3. Verbal Absurdities I	59	1	55	5	55	5	N.S.	N.S.	N.S.
4. Similarities and differences	58	2	59	1	57	3	N.S.	N.S.	N.S.
5. Comprehension IV	58	2	60	0	58	2	N.S.	N.S.	N.S.
6. Memory for sentences II	55	5	50	10	54	6	N.S.	N.S.	N.S.
Year IX									
1. Paper cutting I	44	16	51	9	40	20	N.S.	N.S.	N.S.
2. Verbal absurdities II	47	13	46	14	42	18	N.S.	N.S.	N.S.
3. Memory for designs	49	11	42	18	40	20	N.S.	N.S.	N.S.
4. Rhymes: New form	51	9	60	0	57	3	<.01	N.S.	N.S.
5. Making change	58	2	52	8	42	18	N.S.	<.01	N.S.
6. Repeating 4 digits reversed	43	17	44	16	36	24	N.S.	N.S.	N.S.
Year X									
1. Vocabulary	39	21	39	21	37	23	N.S.	N.S.	N.S.
2. Picture absurdities II Frontier Days	43	17	47	13	41	19	N.S.	N.S.	N.S.
3. Reading and report	9	45	15	45	29	21	N.S.	<.01	<.01
4. Finding reasons I	20	40	31	29	43	17	N.S.	<.01	N.S.
5. Word naming	43	17	38	22	39	21	N.S.	N.S.	N.S.
6. Repeating 6 digits	30	30	28	32	25	35	N.S.	N.S.	N.S.

TABLE 104--Continued

Subtest: Number and Name	Frequency						Significance of CR: Frequency Passing		
	B1		B2		B3		B1:B2	B1:B3	B2:B3
	P	F	P	F	P	F			
Year XI									
1. Memory for designs	27	33	16	44	18	42	N.S.	N.S.	N.S.
2. Verbal absurdities	17	43	10	50	15	45	N.S.	N.S.	N.S.
3. Abstract words I	26	34	4	56	14	46	<.01	N.S.	N.S.
4. Memory for sentences IV	36	24	25	35	27	33	N.S.	N.S.	N.S.
5. Problem situation	41	19	28	32	29	31	N.S.	N.S.	N.S.
6. Similarities: three things	23	37	38	22	42	18	N.S.	<.01	N.S.
Year XII									
1. Vocabulary	12	48	1	59	3	57	<.01	N.S.	N.S.
2. Verbal absurdities II	20	40	14	46	18	42	N.S.	N.S.	N.S.
3. Response to pictures II: Messenger Boy	8	52	3	57	7	53	N.S.	N.S.	N.S.
4. Repeating 5 digits reversed	11	49	11	49	9	51	N.S.	N.S.	N.S.
5. Abstract words II	23	37	19	41	16	44	N.S.	N.S.	N.S.
6. Minkus completion	0	60	8	52	7	53	<.01	N.S.	N.S.
Year XIII									
1. Plan of search	13[a]	19[a]	10[a]	17[a]	10[a]	26[a]	N.S.	N.S.	N.S.
2. Memory for words	12[a]	20[a]	7[a]	20[a]	5[a]	31[a]	N.S.	N.S.	N.S.
3. Paper cutting I	7	53	3	57	3	57	N.S.	N.S.	N.S.
4. Problems of fact	13	47	11	49	13	47	N.S.	N.S.	N.S.
5. Dissected sentences	2	58	3	57	5	55	N.S.	N.S.	N.S.
6. Copying a bead chain from memory II	11	49	5	55	7	53	N.S.	N.S.	N.S.
Year XIV									
1. Vocabulary	2	58	0	60	0	60	N.S.	N.S.	N.S.
2. Induction	1	59	1	59	0	60	N.S.	N.S.	N.S.
3. Picture absurdities III: The Shadow	2[a]	21[a]	4[a]	16[a]	5[a]	11[a]	N.S.	N.S.	N.S.
4. Ingenuity	1	59	0	60	0	60	N.S.	N.S.	N.S.
5. Orientation: Direction I	1[a]	24[a]	7[a]	16[a]	1[a]	23[a]	N.S.	N.S.	N.S.
6. Abstract words II	9	51	3	57	3	57	N.S.	N.S.	N.S.
Average Adult									
1. Vocabulary	0	60	0	60	0	60			
2. Codes	0	60	0	60	0	60			
3. Differences between abstract words	0	60	0	60	0	60			
4. Arithmetical reasoning	0	60	0	60	0	60			
5. Proverbs I	0	60	0	60	0	60			
6. Ingenuity	0	60	0	60	0	60			
7. Memory for sentences V	0	60	0	60	0	60			
8. Reconciliation of opposites	0	60	0	60	0	60			

TABLE 104—Continued

B. Subtests on Which Differences Occurred

Subtest: Number and Name		Comparison-Relationship		
		B1:B2	B1:B3	B2:B3
IX-4	Rhymes	B1 < B2	B1 = B3	B2 = B3
IX-5	Making change	B1 = B2	B1 > B3	B2 = B3
X-3	Reading and report	B1 = B2	B1 < B3	B2 < B3
X-4	Finding reasons	B1 = B2	B1 < B3	B2 = B3
XI-3	Abstract words	B1 > B2	B1 = B3	B2 = B3
XI-6	Similarities: three things	B1 = B2	B1 < B3	B2 = B3
XII-1	Vocabulary	B1 > B2	B1 = B3	B2 = B3
XII-6	Minkus completion	B1 < B2	B1 = B3	B2 = B3

[a] For these subtests, there were not 60 subjects in certain groups because, occasionally, time pressures necessitated that abbreviated forms of the intelligence test be administered to some subjects.

TABLE 105

COMPARISONS OF THE GROUPS IN TERMS OF MENTAL AGE, CHRONOLOGICAL AGE, AND INTELLIGENCE QUOTIENT: SAMPLES EMPLOYED IN THE ANALYSES OF PERFORMANCE ON THE READING SUBTESTS OF THE CALIFORNIA ACHIEVEMENT TESTS, UPPER PRIMARY AND ELEMENTARY BATTERIES, FORM W (MEANS, VARIANCES)

A. OVER-ALL COMPARISONS

	Source	df	SS	MS	F
Mental Age	B	2	8,043.26	4,021.63	40.89***
	Error (b)	237	23,308.34	98.35	
	Total	239	31,351.60		
Chronological Age	B	2	210,189.17	105,094.59	837.81***
	Error (b)	237	29,730.83	125.44	
	Total	239	239,920.00		
Intelligence Quotient	B	2	143,818.13	71,909.06	1,575.22***
	Error (b)	237	10,818.87	45.65	
	Total	239	154,637.00		

B. INDIVIDUAL COMPARISONS

Comparison	s^2	B1:128.67	B2:80.29	B3:86.08
Mental Age	Group	B1 = B2	B1 = B3	B2 = B3
	F	1.60	1.41	1.07
	$\bar{X}$	B1:115.10	B2:117.31	B3:127.48
	Group	B1 = B2	B1 < B3	B2 < B3
	Diff.	2.21	12.38	10.17
	t	0.969	5.359***	4.985***
Chronological Age	s^2	B1:248.19	B2:70.73	B3:57.42
	Group	B1 > B2	B1 > B3	B2 = B3
	F	3.51***	4.32***	1.23
	$\bar{X}$	B1:174.16	B2:115.12	B3:108.22
	Group	B1 > B2	B1 > B3	B2 > B3
	Diff.	59.04	65.94	6.90
	t	29.669***	33.815***	5.476***
Intelligence Quotient	s^2	B1:22.12	B2:36.99	B3:77.83
	Group	B1 = B2	B1 < B3	B2 = B3
	F	1.67	3.51***	2.10
	$\bar{X}$	B1:69.64	B2:104.36	B3:129.36
	Group	B1 < B2	B1 < B3	B2 < B3
	Diff.	34.72	59.72	25.00
	t	40.372***	53.321***	20.833***

***$p < .001$

TABLE 106

COMPARISONS OF THE GROUPS IN TERMS OF ACHIEVEMENT TEST PERFORMANCE: TOTAL READING, READING VOCABULARY, AND READING COMPREHENSION GRADE PLACEMENT; CALIFORNIA ACHIEVEMENT TESTS, UPPER PRIMARY AND ELEMENTARY BATTERIES, FORM W (MEANS, VARIANCES)

A. OVER-ALL COMPARISONS

	Source	df	SSX	SSXY	SSY	SS′Y′	df	MS′Y	F
Total Reading	B	2	8,043.26	662.3	105.41	156.33	2	78.16	61.06***
	Error (b)	237	23,308.34	-999.1	356.30	301.77	236	1.28	
	Total	239	31,351.60	-336.8	461.71	458.10	238		
Reading Vocabulary	B	2	8,043.26	507.2	122.40	122.33	2	61.15	16.44***
	Error (b)	237	23,308.34	- 13.2	878.82	878.81	236	3.72	
	Total	239	31,351.60	494.0	1,001.22	1,001.14	238		
Reading Comprehension	B	2	8,043.26	697.2	86.30	78.61	2	34.61	20.36***
	Error (b)	237	23,308.34	-168.9	402.76	401.54	236	1.70	
	Total	239	31,351.60	528.3	489.06	480.15	238		

B. INDIVIDUAL COMPARISONS

Comparison				
	s^2	B1:1.12	B2:1.39	B3:2.00
Total Reading	Group	B1 = B2	B1 = B3	B2 = B3
	F	1.24	1.79	1.44
	$\overline{Y}$	B1:3.74	B2:5.16	B3:5.14
	$\overline{Y}'$	B1:3.55	B2:5.06	B3:5.44
	Group	B1 < B2	B1 < B3	B2 = B3
	Diff.	1.51	1.89	0.38
	t	8.88***	9.95***	2.11
Reading Vocabulary	s^2	B1:7.26	B2:1.53	B3:2.33
	Group	B1 > B2	B1 > B3	B2 = B3
	F	4.74***	3.11***	1.52
	$\overline{Y}$	B1:3.70	B2:5.29	B3:5.13
	$\overline{Y}'$	B1:3.69	B2:5.28	B3:5.14
	Group	B1 < B2	B1 < B3	B2 = B3
	Diff.	1.59	1.45	0.14
	t	5.678***	4.531***	0.467
Reading Comprehension	s^2	B1:1.17	B2:1.70	B3:2.23
	Group	B1 = B2	B1 = B3	B2 = B3
	F	1.45	1.91	1.31
	$\overline{Y}$	B1:3.87	B2:5.03	B3:5.23
	$\overline{Y}'$	B1:3.84	B2:5.01	B3:5.28
	Group	B1 < B2	B1 < B3	B2 = B3
	Diff.	1.17	1.44	0.27
	t	8.850***	6.545***	1.350

***$p < .001$.

and the mean CA of the normal subjects exceeded that of the superior subjects; the reverse of these relationships existed when the groups were compared in terms of IQ. The relationships among the several variances were these: MA, homogeneity ov variance in each comparison; CA, homogeneity of variance in the normal and superior groups comparison and heterogeneity of variance in the other two comparisons; IQ, heterogeneity of variance in the retarded and superior groups comparison and homogeneity of variance in the other two comparisons.

Reading Grade Placement

Inspection of Table 106 will reveal data relevant to the analyses of the subjects' relative status in terms of three measures of reading achievement. In mean total reading grade placement, the groups differed. The locations of the differences were these: the mean of the retarded subjects was lower than those of the normal and superior subjects; the means of the normal and superior subjects were equivalent. The results of the analyses of reading vocabulary grade placement and of reading comprehension grade placement revealed that these same relationships obtained in each case. It is interesting to note that the same relationships were apparent among the scores before and after MA was controlled by the use of the analysis of co-variance technique. In these cases, the differences in MA which existed did not appear to affect the response measures examined.

CHAPTER IV

DISCUSSION AND CONCLUSIONS

Three issues--the effects of selected conditions of reinforcement on learning performance and level of aspiration behavior, goal discrepancy scores when conditions of reinforcement are held constant, and responses to selected intellectual tasks when conditions of reinforcement are held constant--were presented in Chapter I as the primary concern in this investigation. Identified as being of special interest in relation to these issues was the influence of certain subject and task characteristics.

Pursuit of the problem thus defined involved administering six different learning tasks to subjects classified into three intelligence groups (B) who performed under the overlapping dimensions of the incentive-reinforcement conditions. The subjects were intellectually retarded (B1), intellectually normal (B2), and intellectually superior (B3) individuals, all of whom had similar mental ages.[1] The tasks included devices designed to reflect discrimination learning, rote learning, and concept formation. In developing these tasks, attempts were made to vary the stimulus-response characteristics along a dimension of complexity. The idea of complexity was based on Underwood's (89) discussion of this matter. Essentially, complexity refers to the number of and the relationships among the elements to be associated. In the present study, the complexity characteristics were implied in the definitions: viz, discrimination learning involved the association of a single discrete stimulus and a single discrete response; rote learning involved the integration of a series of discrete stimuli and a series of discrete responses; concept formation involved the selection of a single response on the basis of the underlying relationship among several stimuli. Two series of tasks were employed: a verbal and a non-verbal series. Within each of these were three tasks dimensionalized on the basis of the idea of complexity just presented and labeled the discrimination learning verbal (DLV), the discrimination learning non,verbal (DLN), the rote learning verbal (RLV), the rote learning non-verbal (RLN), the concept formation verbal (CFV), and the concept formation non-verbal (CFN) tasks. The reinforcement conditions, which were administered within the framework of the level of aspiration model, were designated as orientation (D) and type-frequency (C). The orientation condition included the individual orientation (D1) and the group orientation (D2). The type-frequency condition consisted of the following: 100 per cent success (C1); 66 per cent success--33 per cent failure (C2); 33 per cent success--66 per cent failure (C3); and 100 per cent failure (C4). Appropriate control groups (C5, level of aspiration control, and C6, speed and accuracy control) were utilized also. In addition, there was a terminal change in type-frequency of reinforcement information. Further, during the course of the investigation, there were available data pertinent to the psychometric and achievement test performance of the subjects.

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[1] Actually, the retarded, normal, and superior subjects differed markedly in terms of chronological age and intelligence quotient and differed (significantly) about one year in terms of mental age; that is, the retarded and normal subjects had equivalent mean mental ages and the superior subjects had a mean mental age of one year higher than each of these two. The original intent was to select subjects who were equivalent in terms of mental age; yet, to find superior subjects who had the necessary mental ages and who had been in school long enough to develop certain prerequisite skills would have required a great deal of additional time, expense, and labor. Therefore, control of mental age by selection did not prove feasible though attempts were made in that direction. Statistical control was considered. This was not done for several reasons: such a procedure would have been more laborious and time consuming, and extemely expensive; there was no assurance with the response measures utilized that the assumptions required for valid use of the co-variance technique could be met; the use of co-variance did not change the results of the analyses of achievement test performance and this suggested that for the type of measures involved the differences in mental age which occurred were not highly-related to differences in the criterion measures; the results of the analyses of variance of the learning response measures on the six experimental tasks did not suggest that the mental age differences which occurred were operating to produce differences--even though both the retarded and normal subjects had mean mental ages one year lower than the superior subjects, on the verbal tasks the normal and superior subjects had equivalent means and both exceeded the retarded, while on the non-verbal tasks, the retarded exceeded the normal and both of these exceeded the superior; further, there was no reason to believe that the mental age differences which occurred would influence, to any great extent, the level of aspiration measures.

Chapter II included a detailed discussion of all of the procedures. In Chapter III, the obtained data were presented in terms of each of the six learning tasks and the psychometric and achievement tests. In this chapter, these results will be reorganized and summarized according to a number of topics related to the issues cited above. The consideration of each topic will include questions, data or results, a discussion of these results, and, where warranted, conclusions. However, before proceeding with the discussion, it would seem helpful to outline in detail the topics to be considered and to present the sources of data which pertain to each topic. These are listed below (remember that the sources of the learning and level of aspiration data pertain to all six of the experimental tasks).

I. Effects of selected conditions of reinforcement.

   A. Effect of the conditions of reinforcement learning performance (response measures: attainment time and number of response scores).

1. Level
    - a. Orientation: D, BD
    - b. Type-frequency: C, BC
    - c. Orientation x type-frequency: DC, BDC
2. Pattern
    - a. Orientation: DA, BDA
    - b. Type-frequency: CA, BCA
    - c. Orientation x type-frequency: DCA, BDCA
    - d. Change of type-frequency: CA, DCA, BDCA, and comparison of relationships among pertinent means

B. Effect of the conditions of reinforcement on level of aspiration behavior.

1. Goal discrepancy scores (response measures: absolute, positive, and negative goal discrepancy scores).
    - a. Size
        1. Orientation: D, BD
        2. Type-frequency: C, BC
        3. Orientation x type-frequency: DC, BDC
    - b. Change of size over trials
        1. Orientation: DA, BDA
        2. Type-frequency: CA, BCA
        3. Orientation x type-frequency: DCA, BDCA
        4. Change of type-frequency: CA, DCA, BDCA, and comparison of relationships among pertinent means
2. Changes of direction of goals after success and failure (response measures: for each trial, frequency in each cell related to success raised, success lowered, success no change, failure raised, failure lowered, and failure no change).

II. Goal discrepancy scores--conditions of reinforcement held constant (response measures: absolute, positive, and negative goal discrepancy scores).

A. Size: B
B. Change of size over trials: A
C. Pattern: BA

III. Performance on intellectual tasks--conditions of reinforcement held constant.

   A. Psychometric test performance (response measures: frequency of success and failure on subtests of the 1937 Revision of the Stanford-Binet Test of Intelligence, Form L).

   B. Achievement test performance (response measures: grade placement on the comprehension and reading vocabulary subtests of the California Achievement Test, Upper Primary and Elementary Batteries, Form W).

   C. Performance on the six learning tasks--conditions of reinforcement held constant (response measures: attainment time and number of responses scores).

      1. Change of level over trials: A
      2. Level: B
      3. Pattern: BA

Effects of Selected Conditions of Reinforcement

The topic, effects of selected conditions of reinforcement, is of concern in this section. This topic may be restated as response to the conditions of reinforcement. Two types of responses will be considered: learning performance and level of aspiration behavior. Related to each of these will be the influence of variations in task and subject characteristics.

Effects of the Conditions of Reinforcement on Learning Performance

Whether the administration of incentive-reinforcement conditions affects subjects' task performance has been the problem of a number of investigations. These include studies in which material reward (1, 30, 85, 86), praise and reproof (6, 10, 31, 35, 38, 40, 41, 67, 84), competition (11, 15, 22, 29, 43, 48, 53, 57, 58, 63, 72, 77, 87, 94), success and failure (3, 5, 10, 16, 28, 33, 37, 44, 50, 71, 75, 79), and, the setting of goals (4) were the incentive-reinforcement conditions. Although there were exceptions, most investigators observed that subjects to whom were administered some kind of incentive-reinforcement condition performed more adequately than control subjects. Nevertheless, when all of the evidence is considered, it is questionable whether it was demonstrated conclusively that within any one type of reinforcement, one variant was consistently superior to another. Further, some effort was made in several investigations to assess the influence in response to incentive-reinforcement conditions of such subject variables as chronological age (2, 40, 47, 65, 67, 91), sex (40, 67, 91), level of intelligence (1, 40, 75, 88), level of academic achievement (40, 47, 68, 88, 91), and personality characteristics (26, 27, 31, 34, 38, 39, 44, 55, 65, 69, 71, 79, 84, 88). Pertinent results suggested that the subjects differing in terms of chronological age and sex did not respond in a consistently different manner insofar as the effect of incentive-reinforcement on learning performance. There is a dearth of such evidence in relation to personality characteristics, intelligence level, and academic achievement. Consequently, a number of unresolved problems appear to remain and these need to be investigated.

In this section, the focus is on the results of the extension of some of the earlier work in this area; that is, the emphasis is on exploring the effects of variations in incentive-reinforcement conditions on learning performance and the relationship of task and subject variations to these effects. When these problems are translated in terms of the specific procedures utilized in this study, the following questions result. What is the effect of the orientation condition on learning performance? What is the effect of the type-frequency condition on learning performance? Is there an interaction effect of these two reinforcement conditions on learning performance? Did the change of reinforcement information to 100 per cent success in the last section of trials affect learning performance? Do subject and task variations influence the effects of the conditions of reinforcement on learning performance? Pertinent evidence is presented in Table 107 and the text below.

The data yielded by the comparisons of the mean levels of learning performance attained by the groups of subjects who received the sets of orientation information indicated this: the mean attainment times, and in the appropriate cases, the mean number of responses of the groups were equivalent. This was the case for all six tasks. Accordingly, there was consistency in the relationships observed among tasks in both the verbal and non-verbal series.

With one exception, similar results obtained when the groups to whom were administered the different type-frequency sets of information were compared. The one exception: there was a suggestion that a difference occurred among the mean number of responses scores of the subjects who received the several sets of information on the CFV. Further analyses revealed that the C2 group had a higher mean than the C1, C4, and C6 groups, and the C5 group had a higher mean than the C6 group. In all other comparisons between type-frequency groups, the means were equivalent. For both the attainment time and number of responses measures, no differences occurred among the means of the type-frequency groups on the remaining five tasks. It would follow that, with the exception noted, there was consistency among tasks in terms of the subjects' response

TABLE 107

COMPARISON OF THE GROUPS IN TERMS OF THE EFFECTS OF SELECTED CONDITIONS OF REINFORCEMENT ON LEARNING PERFORMANCE: SUMMARY OF RELATIONSHIPS APPARENT AMONG MEAN ATTAINMENT TIME AND NUMBER OF RESPONSES SCORES

	Response Measure	Tasks--Probability of F					
		DLV	RLV	CFV	DLN	RLN	CFN
Orientation (D)	Att.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	No. R	N.S.	N.S.	N.S.			
Type-Frequency (C)	Att.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	No. R.	N.S.	N.S.	.01[a]			

[a] C1<C2; C1=C3; C1=C4; C1=C5; C1=C6; C2=C3; C2>C4; C2=C5; C2>C6; C3=C4; C3=C5; C3=C6; C4=C5; C4=C6; C5<C6.

	Response Measure	Tasks--Probability of F					
		DLV	RLV	CFV	DLN	RLN	CFN
Orientation x Type-Frequency (DC)	Att.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	No. R.	N.S.	N.S.	N.S.			
Orientation x Trials (DA)	Att.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	No. R.	N.S.	N.S.	N.S.			
Type Frequency x Trials (CA)	Att.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	No. R.	N.S.	N.S.	N.S.			
Orientation x Type-Frequency x Trials (DCA)	Att.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	No. R.	N.S.	N.S.	N.S.			
Intelligence Level x Orientation (BD)	Att.	N.S.	.01[a]	N.S.	N.S.	.001[b]	N.S.
	No. R.	N.S.	N.S.	N.S.			

[a] D1: B1=B2; B1>B3; B2>B3; D2: B1>B2; B1>B3; B2=B3.
[b] D1: B1=B2; B1<B3; B2<B3; D2: B1<B2; B1<B3; B2<B3.

	Response Measure	Tasks--Probability of F					
		DLV	RLV	CFV	DLN	RLN	CFN
Intelligence Level x Type-Frequency (BC)	Att.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	No. R.	N.S.	N.S.	N.S.			

TABLE 107--Continued

	Response Measure	Tasks--Probability of F					
		DLV	RLV	CFV	DLN	RLN	CFN
Intelligence Level x Orientation x Type-Frequency (BDC)	Att.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	No. R.	N.S.	N.S.	N.S.			
Intelligence Level x Orientation x Trials (BDA)	Att.	N.S.	.001[a]	N.S.	N.S.	N.S.	N.S.
	No. R.	N.S.	.001[b]	N.S.			

[a] D1A1: B1=B2; B1>B3; B2=B3. D2A1: B1>B2; B1=B3; B2=B3.
D1A2: B1=B2; B1>B3; B2=B3. D2A2: B1>B2; B1>B3; B2=B3.
D1A3: B1=B2; B1>B3; B2=B3. D2A3: B1>B2; B1>B3; B2=B3.
D1A4: B1=B2; B1=B3; B2=B3. D2A4: B1>B2; B1>B3; B2=B3.

[b] D1A1: B1=B2; B1>B3; B2=B3. D2A1: B1>B2; B1=B3; B2=B3.
D1A2: B1=B2; B1>B3; B2=B3. D2A2: B1>B2; B1>B3; B2=B3.
D1A3: B1=B2; B1>B3; B2=B3. D2A3: B1>B2; B1>B3; B2=B3.
D1A4: B1=B2; B1>B3; B2=B3. D2A4: B1>B2; B1>B3; B2=B3.

	Response Measure	Tasks--Probability of F					
		DLV	RLV	CFV	DLN	RLN	CFN
Intelligence Level x Type-Frequency x Trials (BCA)	Att.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	No. R.	N.S.	N.S.	N.S.			
Intelligence Level x Orientation x Type-Frequency x Trials (BDCA)	Att.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	No. R.	N.S.	N.S.	N.S.			

to the different sets of type-frequency information: all responded, insofar as the learning measures were concerned, in a similar fashion to the several tasks in both the verbal and non-verbal series.

When the interaction effect of the two conditions on learning performance was tested, significant statistics were not obtained. This was the case for both attainment time and, where appropriate, number of responses for all six tasks; consequently, in both the verbal and the non-verbal series, there was consistency among tasks in this respect.

For each of the six tasks, there was no evidence that the subjects who received the different orientations showed a differential pattern of decrements in either attainment time scores or, where appropriate, number of responses over the four sections of trials. The question pertaining to consistency can be answered in the affirmative: insofar as pattern of learning performance is concerned, the orientation groups responded in a similar fashion on each of the six tasks. The results pertinent to the effect of the type-frequency sets of information on pattern of learning performance are similar to those pertinent to the effect of the orientation information; i.e., on no task, in terms of either the attainment time or, where appropriate, the number of responses measures, did the subjects who received the several type-frequency sets of information respond differently over the series of trials. Consequently, there was consistency over the six tasks: the subjects who received the six type-frequency sets of information responded in a similar manner to each task.

Non-significant F ratios associated with the DCA interactions were yielded by the analyses of the data obtained on the six tasks. Hence, for both the attainment time and, where appropriate, number of responses measures, there was no differential reaction by the subjects receiving the orientation and type-frequency conditions as they responded to the several sections of trials of each task. And, of course, it follows that there was consistency in the manner in which the subjects responded within the two series of tasks.

It was noted above that non-significant F ratios were associated with the C factor and with the CA and the DCA interactions related to both response measures and it was inferred that the subjects receiving the several type-frequency sets of information did not react differently over the several sets of trials. Consequently, there is no reason to believe that subjects who previously received differential frequencies of failure and then received 100 per cent success information on the last four trials responded differently during this latter section of trials. This was the case for all six tasks and thus there was consistency among tasks.

In terms of both attainment time and, in the appropriate cases, number of responses scores, the subjects in the three intelligence groups did not respond differentially to the different orientations administered during performance on the DLV, the DLN, the CFV, and the CFN. On the other hand, there is evidence that the subjects responded differently in terms of RLV attainment time (but not number of responses), and RLN attainment time. The nature of this differential response is described below. For RLV attainment time, of the subjects who received the individual orientation, the superior subjects had a smaller mean than the retarded and the normal subjects and the latter two groups had equivalent means; of the subjects who received the group orientation, the retarded subjects had a larger mean than the normal subjects and the superior subjects, while the latter two groups of subjects did not differ. For RLN attainment time, of the subjects who received the individual orientation, the retarded and normal subjects had equivalent means and both groups had smaller means than the superior subjects; of the subjects who received the group orientation, the retarded subjects had smaller means than the normal and superior subjects and the normal subjects had smaller means than the superior subjects. Thus, there was not complete consistency among the six tasks in the manner in which the subjects in the three intelligence groups responded to the sets of orientation information. They reacted in the same fashion on the two discrimination learning tasks and the two concept formation tasks; however, on the two rote learning tasks, they responded differently insofar as attainment time was concerned.

When the responsesof the subjects in the three intelligence groups to the type-frequency sets of reinforcement information were compared in terms of mean level of performance, null relationships obtained. This statement applies to both attainment time and, where appropriate, number of responses scores reflecting the subjects' performance on all six tasks. Accordingly, there would seem to be consistency. The subjects in the three intelligence groups responded in the same manner to the type-frequency sets of information administered relevant to performance on the tasks in both the verbal and the nonverbal series.

On none of the six tasks were significant F ratios associated with the BDC interactions related to the attainment time scores or, in the appropriate cases, the number of responses scores. Consequently, there is no reason to believe that there was a differential effect of these conditions of reinforcement on the level of learning performance of the subjects in the three intelligence groups. And, it follows, there was consistency among the six tasks.

Insofar as attainment time.. and, in the appropriate cases, number of responses scores are concerned, there is no indication of differential effects as reflected by the interaction of intelligence level, orientation, and trials when comparisons were made of performance on the DLV, DLN, RLN, CFV, and CFN. On the other hand, there is evidence of a differential reaction on the RLV; here significant F ratios are associated with the BDA interaction of both the attainment time and number of responses scores. The location of these differential responses is described below. Consider first the attainment times of the subjects who received the individual orientation. On the first, second, and third sections of trials, the retarded subjects had larger means than the superior subjects; in all of the remaining comparisons, the means were equivalent. Of the subjects who received the group orientation, on all four sections of trials, the retarded subjects had a larger mean than the normal subjects and on the second, third, and fourth sections, the means of the retarded subjects were larger than those of the superior subjects; in the remaining comparisons, the means were equivalent. With one exception, the relationships apparent among the attainment times were present when the relationships among number of responses scores were examined. This exception was on the fourth section of trials. Here, the retarded subjects who received the individual orientation differed from the normal subjects who received the same orientation. Thus, there is not complete consistency among tasks in the effect of the orientation condition on the pattern of the learning performance of the subjects in the three intelligence groups.

For all six tasks, the evidence indicated no interaction of intelligence level, type-frequency, and trials. This statement applies to attainment times and, where appropriate, number of responses scores. Consequently, there was consistency in terms of this comparison among the six tasks. The subjects did not respond differently.

Null relationships were apparent when an evaluation was made of the interaction of intelligence level, orientation, type-frequency, and trials. This was the case for both attainment time and, where appropriate, number of responses scores for all six tasks. Accordingly, there was consistency among tasks.

It was noted just previously that on each of the six tasks, non-significant F ratios were associated with the CA, BCA, and BDCA interactions related to the response measures. Hence, there is no reason to believe that the subjects in the three intelligence groups who received the change of type-frequency information responded differently at the last section of trials. In view of these null relationships pertinent to each task, it would follow that there was consistency among tasks.

In summary, the following statements are appropriate in relation to the previously stated questions about the effects of the administration of the conditions of reinforcement on the subjects' learning performance as it was reflected by the attainment time and, where appropirate, number of responses scores; these statements apply to the relationships among the over-all means, the relationships among the trends of the means over the four sections of trials, and the relationships of the means in the last section of trials to those in the preceding three sections.

What is the effect of the type-frequency condition on learning performance? With one exception, the learning performance of the four groups of subjects to whom were administered the several frequencies of success and failure in relation to the goals they set for themselves did not differ. The one difference which did occur was not systematic and is limited in implication. Neither did the learning performance of these groups differ from that of the control group who set goals and received bona fide performance information. Further, the learning performance of these success-failure groups and this goal-setting control group did not differ from that of the control group who received only bona fide performance information. What is the effect of the orientation condition on learning performance? Subjects to whom success or failure information was administered within the framework of their own past performance did not differ in terms of learning performance from subjects to whom success or failure was administered within the framework of their peer group's performance. Is there an interaction effect of the orientation and type-frequency conditions on learning performance? The subjects who received different combinations of the two reinforcement treatments did not differ in terms of learning performance. Did the change of type-frequency information to 100 per cent success in the last section of trials effect learning performance? The performance of subjects who received a change of reinforcement on the final section of trials did not differ from their performance on preceding trials, that of other subjects who did not receive a terminal change of reinforcement, or that of control subjects. Do subject and task variations influence the effects of the condition of reinforcement on learning performance? Subject variations exerted no influence. Neither did task variations.

Previously, there was presented a survey of a number of investigations of the influence of several incentive-reinforcement conditions on learning performance. In general, the results obtained in this study differ from those obtained by investigators who reported the following: control subjects performed less adequately than subjects who received praise and reproof (6, 31, 35, 38, 40, 41), success and failure (3, 5, 16, 75), competition sets (11, 15, 22, 43, 48, 53, 57, 58, 63, 72, 78, 87, 94), or set goals (4); subjects who received variants of these types of reinforcement information differed in performance adequacy (31, 41, 57, 72, 84), subjects who differed in terms of intelligence or related variables differed in response to these aspects of reinforcement (40, 75). These results are in agreement with those reported by investigators who found null relationships pertinent to the several topics to be extant (6, 10, 29, 31, 35, 38, 40, 41, 67, 88, 91).

Insofar as the discrepant results are concerned, a number of procedural variations may be suggested as possible explanatory factors.[1] These pertain to characteristics of the reinforcement information, aspects of the task situation, nature of the control groups, and factors related to the administration of the tasks.

Consider first the characteristics of the reinforcement information. It may be that the reinforcement information utilized herein was not strong enough and, related to this, that this information was not realistic in terms of performance. Yet, there is some evidence contradictory to this idea. When the comments made in this study and those made in many other studies employing children as subjects are compared, it doesn't appear that one set of comments is particularly stronger than another. In addition, data associated with the level of aspiration responses indicate two relationships which are pertinent here. First, for the groups as a whole, the goal discrepancy scores were small, *i.e.*, the subjects tended to set their goals relatively close to their reported performance levels. Second, the majority of times, after success the subjects tended to raise their goals and after failure they tended to lower them. It seems likely that if the subjects had not accepted the situations as *bona fide* ones, these relationships would not have been apparent. Further, observational evidence may be cited. In many cases, when the subjects received failure information, especially repeated failure information, they manifested overt verbal and bodily expressions which might be interpreted as indicating concern. In many situations in which they received success information, the converse was apparent. This behavior was marked.

Several aspects of the task situation may have been influential. Perhaps, the tasks were not sensitive enough in the sense that the performance measures may not have reflected differences in the subjects' responses. Yet, ostensibly, they are of the same type generally as those used by other investigators. In addition, one reason that both time and number of responses were employed as performance measures was in the event that one might be more susceptible than another in this respect. Also, it may be that so many tasks were administered--and thus the subjects served under several combinations of conditions of reinforcement--that the reinforcement information generally became ineffective. The points cited relevant to the strength and reality of the reinforcement information pertain here. Further, in most cases, a reasonable period of time intervened between the administration of tasks. In addition, if this argument were valid, the subjects' performance on the RLN, but not on the remaining five tasks, might have been affected because the RLN was administered to almost all of the subjects initially and then the remaining tasks were administered in an irregular order. However, the subjects' learning performance on the RLN did not appear to be affected by the conditions of reinforcement to any greater extent than their performance on the other tasks did. This is considered contradictory evidence to the argument.

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[1] These aspects of procedure to be discussed were present, to some extent, in the studies in which the results were consistent with those reported here, but apparently they did not operate to produce different relationships.

Another factor of importance was the nature of the control groups. Bona fide performance information was administered to the control groups in the present investigation. Such a procedure was not followed in many of the other studies. It may be that such knowledge of results, and perhaps implicit recognition of success or failure, operated as reinforcement information which was as effective as the investigators' comments about success and failure were. On the other hand, it may be that control subjects (in other studies) who received no performance information did not receive such implicit reinforcement and, consequently, performed less adequately than subjects to whom reinforcement information was administered as a part of the experimental procedure. When the procedures were being planned, this administration of performance information to control subjects was recognized as a major methodological variation; however, the responses of subjects operating without knowledge about their performance were not considered of practical concern in this study.

Several factors related to the administration of the tasks and reinforcement conditions may be pertinent. First, these were administered by outsiders (i.e., persons with whom the subjects did not have consistent daily contact and/or who did not have a definitely defined public school position), and this might have operated to attenuate the subjects' reactions to the reinforcement information. However, the points made about the realism of the situation for the subjects may be cited again. And, in most of the other studies, outside investigators rather than classroom teachers or similar personnel presented the situation to the subjects. Also, there is some evidence that the use of different people to administer the reinforcement information does not influence systematically its effect (3, 5, 16, 87). Two other important factors related to administration are these: subjects were dealt with individually instead of in groups and the locus of the contact was a separate room in the school rather than the subject's classroom. On the other hand, the procedure involved a test-like situation and school-like material.

Appropriate also is specific discussion of one more point; that is, the lack of differential reaction of the retarded subjects to the reinforcement information. If these subjects were going to respond differentially to the conditions of reinforcement, then those receiving the different sets of reinforcement information should have differed from each other, the retarded subjects in the control groups, and, perhaps, the normal and superior subjects. It has been suggested that retarded subjects, who often have had a long history of failure in school and school related activities, have a relatively low tolerance for failure and experience in test or test-like situations, especially verbal ones, anxiety and other negative reactions which, in turn, may influence their performance in an inimical manner (7, 12, 66). To a certain extent, general observation of some retarded individuals supports this idea. Yet, there was no consistent evidence yielded by this study that failure or success information--couched in either the group or individual framework--exerted any effect, differential or otherwise, on the learning performance of these subjects. The several explanatory factors cited above pertain to this observation. In addition, perhaps if the retarded subjects (from the public school here) had been members of an institutional population, they would have responded differently;[1] or, it could be that retarded subjects selected on the basis of a criterion related to attitudes toward school activities or failure in school activities would have reacted in another manner to the reinforcement information. Currently, in the absence of further data, the only comment which would seem appropriate is this: it may be that retarded subjects and those experiencing high anxiety are threatened in test or test-like situations--especially verbal ones or ones in which they experience failure--and that this affects their performance; but, the subjects employed were not so affected in the situations utilized in this investigation.

It is difficult to evaluate the several explanatory factors cited above; more study is needed. Generally, at the present time, it would seem justifiable to conclude the following: subjects who receive the aspects of reinforcement information utilized (considered either singly or in combination) related to goals they set for themselves do not differ in learning performance from subjects who set goals and receive performance information or from subjects who only receive performance information; subjects who set goals and receive performance information do not differ in learning performance from subjects who do not set goals but who receive performance information; subjects who receive the several variations of the reinforcement information do not differ in learning performance; subjects who differ in terms of intelligence level and, to some extent, level of academic achievement (and, it is assumed, past history of academic success and failure) do not differ in their response to the several reinforcement conditions insofar as this response is reflected by learning performance; also, insofar as learning performance is concerned, subjects react to the conditions of reinforcement in a similar fashion when they are administered during response to verbal and non-verbal tasks dimensionalized according to complexity. These generalizations are limited to situations and subjects similar to those involved in this investigation. An especially important limitation is related to the time factor. The evidence here pertains to immediate, short term administrations of reinforcement information. It may be that reinforcement administered continuously over a more extended period of time would have a different effect (41, 82). Subsequent research would be helpful.

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[1] The question implied here--the generality of the obtained results when institutionalized retarded individuals are employed as subjects--is being investigated at the present time. This investigation is being conducted as the project, "Studies of the Effects of Systematic Variations of Certain Conditions Related to Learning. I, Conditions of Reinforcement-An Extension," supported by a grant from the U.S. Office of Education, Department of Health, Education, and Welfare pursuant to Contract No. SAE-8742, under the administration of the Syracuse University Research Institute, Louis A. Fleigler, Project Director and Kathryn A. Blake, Permanent Consultant.

Effects of the Conditions of Reinforcement on Level of Aspiration Behavior

In general, it is considered that individuals engaged in most goal directed activities attempt to succeed, that is, to attain the goals they set for themselves or accept. When they are engaged in an activity within the range of accomplishment (neither too easy nor too difficult), individuals involved in the goal setting process may respond in several ways insofar as the relationships between the goals they state and their recognized level of performance are concerned. They may set goals which are the same as, slightly higher, slightly lower, very much higher, or very much lower than their performance level. Two aspects of this process are of interest here: to wit, the difference between the set goal and the preceding performance level, and the direction in which goals are changed after attainment or non-attainment of previously set goals. Individuals respond differently in terms of these aspects of goal setting behavior. Determinants of these differential reactions have been the subject of some investigation. In this study, the roles of subject variations, task variations, and reinforcement variations are of concern. The major issue in this section pertains to the effects of the incentive-reinforcement variations and to the influence of task variations and subject variations in relation to these effects.

There has been very little previous study of the effect of immediate, explicit success and failure on the size of children's goal discrepancy scores. Probably, aspects of Sears' (68) work are most pertinent; yet, the implications of the relevant results are rather unclear. This paucity of previous data is also the case when the role of group standards in the size of children's goal discrepancy scores is examined.

TABLE 108

COMPARISON OF THE GROUPS IN TERMS OF THE EFFECTS OF SELECTED CONDITIONS OF REINFORCEMENT ON GOAL DISCREPANCY SCORES: SUMMARY OF RELATIONSHIPS APPARENT AMONG MEAN ABSOLUTE, POSITIVE, AND NEGATIVE GOAL DISCREPANCY SCORES

	Response Measure	Tasks--Probability of F					
		DLV	RLV	CFV	DLN	RLN	CFN
Orientation (D)	G.D.Ab.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.+	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.-	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Type-Frequency (C)	G.D.Ab.	N.S.	N.S.	N.S.	N.S.	.001[b]	N.S.
	G.D.+	N.S.	N.S.	.001[a]	N.S.	.001[c]	N.S.
	G.D.-	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

[a] C1<C2; C1=C3; C1<C4; C1<C5; C2=C3; C2<C4; C2=C5; C3<C4; C3<C5; C4<C5.

[b] C1=C2; C1=C3; C1=C4; C1=C5; C2=C3; C2=C4; C2<C5; C3=C4; C3=C5; C4=C5.

[c] C1=C2; C1=C3; C1<C4; C1<C5; C2=C3; C2=C4; C2=C5; C3=C4; C3=C5; C4=C5, [illegible].

	Response Measure	Tasks--Probability of F					
		DLV	RLV	CFV	DLN	RLN	CFN
Orientation x Type-Frequency (DC)	G.D.Ab.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.+	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.-	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Orientation x Trials (DA)	G.D.Ab.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.+	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.-	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Type-Frequency x Trials (CA)	G.D.Ab.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.+	N.S.	N.S.	.01[a]	N.S.	.01[b]	N.S.
	G.D.-	N.S.	N.S.	N.S.	N.S.	.01[c]	N.S.

[a] A1:C1=C2; C1=C3; C1=C4; C1=C5; C2=C3; C2=C4; C2=C5; C3=C4; C3=C5; C4=C5. A2:C1<C2; C1<C3; C1<C4; C1<C5; C2=C3; C2=C4; C2=C5; C3=C4; C4=C5; C3=C5. A3:C1=C2; C1=C3; C1<C4; C1<C5; C2=C3; [illegible]; C2=C4; C2=C5; C3=C4; C3=C5; C4>C5. A4:C1=C2; C1= C3; C1=C4; C1=C5; C2=C3; C2=C4; C2=C5; C3=C4; C3=C5; C4=C5.

[b] A1:C1=C2; C1=C3; C1=C4; C1=C5; C2=C3; C2=C4; C2=C5; C3=C4; C3=C5; C4=C5. A2:C1=C2; C1=C3; C1<C4; C1=C5; C2=C3; C2=C4; C2=C5; C3=C4; C3=C5; C4=C5. A3:C1=C2; C1=C3; C1=C4; C1=C5; C2=C3; C2=C4; C2=C5; C3=C4; C3=C5; C4=C5. A4:C1=C2; C1=C3; C1=C4; C1=C5; C2=C3; C2=C4; C2<C5; C3=C4; C3<C5; C4<C5.

[c] A1:C1=C2; C1=C3; C1=C4; C1=C5; C2=C3; C2=C4; C2=C5; C3=C4; C3=C5; C4=C5. A2:C1=C2; C1=C3; C1<C4; C1=C5; C2=C3; C2=C4; C2=C5; C3=C4; C3=C5; C4=C5. A3:C1=C2; C1=C3; C1<C4; C1=C5; C2=C3; C2<C4; C2=C5; C3=C4; C3=C5; C4>C5. A4:C1<C2; C1<C3; C1<C4; C1=C5; C2=C3; C2=C4; C2=C5; C3=C4; C3=C5; C4=C5.

TABLE 108--Continued

	Response Measure	Tasks--Probability of F					
		DLV	RLV	CFV	DLN	RLN	CFN
Orientation x Type-Frequency x Trials (DCA)	G.D. Ab.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.+	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.-	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Intelligence Level x Orientation (BD)	G.D. Ab.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.+	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.-	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Intelligence Level x Type-Frequency (BC)	G.D. Ab.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.+	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.-	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Intelligence Level x Orientation x Type-Frequency (BDC)	G.D. Ab.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.+	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.-	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Intelligence Level x Orientation x Trials (BDA)	G.D. Ab.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.+	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.-	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Intelligence Level x Type-Frequency x Trials (BCA)	G.D. Ab.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.+	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.-	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Intelligence Level x Orientation x Type-Frequency x Trials (BDCA)	G.D. Ab.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.+	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.-	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

TABLE 109

COMPARISON OF THE GROUPS IN TERMS OF THE EFFECTS OF SELECTED CONDITIONS OF REINFORCEMENT ON CHANGES OF DIRECTIONS OF GOAL AFTER SUCCESS AND FAILURE: SUMMARY OF RELATIONSHIPS AMONG FREQUENCIES RAISING, LOWERING, AND NOT CHANGING GOALS AFTER SUCCESS AND FAILURE

Comparison[a] (All B and D Classifications)	DLV,RLV,CFV	DLN,RLN,CFN	Number of Critical Ratios Occurring at $p < .01$					
	Trial No.	Trial No.	SR	SL	SNC	FR	FL	FNC
C1,C2,C5	9,10,17,18	3,4,11,12	0	0	0			
C3,C4,C5	9,10,17,18	3,4,11,12				0	0	0
C1,C2,C3,C5	11,14,15,19	5,8,9,13	1[b]	0	0			
C2,C3,C4,C5	12,13,16,20	6,7,10,14				0	1[d]	0
C1,C2,C3,C4,C5	21,22,23	15,16,17	1[c]	0	0			

[a] N. B.: It will be remembered that for each of the C groups listed, subgroups involving the B and D classifications were compared resulting in a much larger number of comparisons than are ostensibly present here at first glance.

[b] RLN, Trial 13, SR:B2D2C3 < B1D2C1, and B2D1C1.

[c] RLN, Trial 15, SR:B1D2C3 < B1D1C1, B1D2C1, B2D1C1, and B2D2C2.

[d] CFV, Trial 13, FL:B2D1C4 < B1D2C2, B3D1C2, and B3D1C4.

Information is needed about the effects of these factors on goal discrepancy scores. Therefore, the specific questions to be considered pertain to the effect of the orientation condition on the size of the goal discrepancy scores, the effect of the type-frequency condition on the size of the goal discrepancy scores, the interaction effect of these two conditions on the goal discrepancy scores, the effect of changing the type-frequency information on the goal discrepancy scores, and the influence of subject variations and task variations on these effects.

Now consider the second aspect of the goal setting process: the directions in which goals are altered after attainment or non-attainment of the immediately preceding goals. Consistent with the discussion of other topics, the primary issue here is the effect of, and the interaction effect of, incentive-reinforcement variations, subject variations, and task variations on directions of goal alterations after attainment or non-attainment of previously set goals. The results of some of the previous research related to this problem may be summarized as follows. After success, the majority of subjects tend to raise their goals; after failure, to lower them. In both situations, a few subjects tend to keep the same goal. Pertinent to incentive variations--the more marked the subjects perceive the success to be, the more frequently they tend to raise their goals; conversely, the more marked they perceive the failure to be, the more frequently they tend to lower their goals (47). Subjects tend to alter their goals in the directions of the goals they are told that their reference groups hold (4). Pertinent to subject variations--subjects who have a history of habitual success and habitual failure in academic work do not differ in terms of flexibility (number of times the subject changes his goals regardless of direction) or responsiveness (number of times the subject alters his goals in the direction of his immediately preceding performance changes) (68). There has been little study of these issues combined: essentially, whether subjects who have different experiential backgrounds related to academic attainment might manifest differential sensitivity to variations in amount of success and failure or to this success and failure administered within group and indiviual frames of reference. This sort of combination, as it is related to the several tasks, was studied in the present investigation. These problems translated into the terms utilized become the following specific questions. What is the effect of the orientation condition on the frequency with which the subjects change their goals in the several directions after success or failure? What is the effect of the type-frequency condition on the frequency with which the subjects change their goals in the several directions after success or failure? What is the influence of task and subject variations on these effects? Data pertinent to the questions cited immediately above and those pertinent to the questions cited relevant to goal discrepancy scores are presented in Tables 108 and 109 and the text below.

The subjects who received the different orientation sets of information did not differ in terms of the sizes of their absolute, positive and negative goal discrepancy scores. This is the case for each of the six tasks; thus, there was consistency among tasks.

On the DLV, the DLN, the RLV, and the CFN, the subjects who received the several type-frequency sets of information did not differ in terms of mean absolute, positive, or negative goal discrepancy scores. Differences did occur on the RLN and the CFV. On the RLN, there was reason to believe that differences occurred among the absolute and positive goal discrepancy scores but not among the negative goal discrepancy scores. Further scrutiny of the absolute goal discrepancy scores revealed that the mean of the C2 group was smaller than that of the C5 group while in all other possible combinations the means were equivalent. Similarly, subsequent analyses indicated that the mean positive goal discrepancy score of the C1 group was smaller than those of the C4 and C5 groups and that the means in all other possible combinations were equal. On the CFV, the evidence suggested that differences occurred among the positive goal discrepancy scores but not among the absolute and negative goal discrepancy scores. These differences were localized as follows: the mean of the C1 group was smaller than those of the C2, C4, and C5 groups; the mean of the C2 group was smaller than that of the C4 group; the mean of the C3 group was smaller than those of the C4 and C5 groups; and the mean of the C4 group was smaller than that of the C5 group; in the remaining comparisons, the means were equivalent. In view of all of this evidence, it cannot be stated that there was complete consistency among tasks insofar as the sizes of the goal discrepancy scores of the subjects in the type-frequency groups were concerned.

According to the data, there was no interaction effect of the orientation and type-frequency conditions on the sizes of the goal discrepancy scores. In other words, on none of the six tasks were significant F ratios associated with the DC interactions related to the absolute, positive, and negative goal discrepancy scores. Consequently, there was a consistency among the tasks.

Non-significant F ratios were associated with the DA interactions related to the three goal discrepancy scores--absolute, positive, and negative--on each of the six tasks. Thus, it may be inferred that the subjects who received the orientation sets of information did not differ in terms of the relationships among the means of each of the three goal discrepancy scores on the several sections of trials. It would follow that there was consistency in the relationships observed among the six tasks.

Non-significant F ratios were associated with the CA interactions related to the three goal discrepancy scores on the

DLV, the DLN, the RLV, and the CFN. Hence, it would seem that no differences occurred among the type-frequency groups in terms of the relationships among the sizes of the mean goal discrepancy scores over the several sections of trials of these tasks. However, there were some indications of differential responses of the groups over the sections of trials of the RLN and CFV. On the RLN, the differential responses were indicated in the positive and negative goal discrepancy scores but not in the absolute goal discrepancy scores. Further analyses revealed the relationships to be these. In terms of the positive goal discrepancy scores on the first section of trials, the means of the groups did not differ; on the second section, the mean of the C1 group was smaller than those of the C2, C3, C4, and C5 groups, and all other means were equivalent; on the third section, the mean of the C4 group was larger than those of the C1 and C5 groups, and all other means were equivalent; on the fourth section, all means were equivalent. In terms of the negative goal discrepancy scores on the first section of trials, the means of the groups did not differ; on the second section of trials, the mean of the C1 group was smaller than that of the C4 group, and the means in the other comparisons were equivalent; on the third section of trials, the mean of the C4 group was larger than those of the C1, C2, and C5 groups, and all other means were equivalent; on the fourth section of trials, the mean of the C1 group was smaller than those of the C2, C3, and C4 groups, and the means in the remaining comparisons were equivalent. There was no evidence that a differential response on the part of the type-frequency groups occurred in relation to the absolute and negative goal discrepancy scores over the trials of the CFV; however, such a difference in response was indicated in relation to the positive goal discrepancy scores. These differences may be localized as follows: on the first section of trials, no differences occurred among means; on the second section, the mean of the C1 group was smaller than that of the C4 group, and all other means were equivalent; on the third section, no differences occurred among means; on the fourth section, the mean of the C5 group was larger than those of the C2, C3, and C4 groups, and all other means were equivalent. Thus, all of these data would seem to indicate that there was not complete consistency among tasks insofar as the interaction effect of type-frequency and trials on the goal discrepancy scores was concerned: some differences were related to one task in the verbal series and one in the non-verbal series.

Non-significant F ratios were associated with the DCA interactions related to all three goal discrepancy scores on each of the six tasks. Consequently, there is no basis for inferring that there occurred an interaction effect of the orientation and type-frequency conditions on the relative sizes of the subjects' mean goal discrepancy scores over the series of trials. And, it follows, that there was consistency among the six tasks.

On the DLV, the DLN, the RLV, and the DFN, non-significant F ratios were associated with the CA and DCA interactions for all three types of goal discrepancy scores. As a result, there is no reason to believe that the subjects who received a change in type-frequency information on the last four trials responded differently from the manner in which they responded on the earlier trials in which they received differential frequencies of success and failure information, or from the manner in which subjects responded who earlier had received other frequencies of success and failure, or from the manner in which control subjects responded. This statement also applies to the absolute goal discrepancy scores on the RLN and CFV and the negative goal discrepancy scores on the CFV where there were non-significant F ratios associated with the CA and DCA interactions. In the case of the positive and negative goal discrepancy scores on the RLN and the positive goal discrepancy scores on the CFV, the CA interactions (but not the DCA interactions) are associated with significant F ratios. However, further scrutiny of the relationships among the means did not reveal differences in scores attributable to the terminal change of type-frequency information. Consequently, there was consistency among tasks pertinent to this relationship.

The subjects in the three intelligence groups responded in a similar fashion to the orientation sets of information. This was the case for the three types of goal discrepancy scores on all six tasks; that is, in no comparison was the F ratio associated with the BD interaction significant. It follows then that, among tasks there was consistency in the manner in which the three groups of subjects responded to the two orientations.

There were no differences among the subjects in the three intelligence groups insofar as the effect of the administration of the several type-frequency sets of information on their goal discrepancy scores. That is, on all six tasks, non-significant F ratios were associated with the CA interactions related to the absolute, positive, and negative goal discrepancy scores. Again, there was consistency among tasks; on all tasks, for all three measures, equivalence obtained.

In no case--absolute, positive, and negative goal discrepancy scores on each of the six tasks--was the F ratio associated with the BDC interaction significant. Consequently, there is no reason to infer that the subjects in the three intelligence groups respond differently to the several combinations of orientation and type-frequency conditions. Since this statement applies to the three measures on the six tasks, consistency is present among tasks in both the verbal and nonverbal series.

Further, as might be expected in view of the above results, the F ratios associated with the BDA, BCA, and BDCA interactions were not significant. This was the case for all three goal discrepancy scores and for all six tasks. Consequently, there was consistency in these respects among the six tasks.

Consider now the evidence related to the frequency with which the subjects changed the direction of their goals after success and failure. Only a few differences occurred and these do not appear to be systematic. Briefly, the differences among frequencies were these: on Trial 13 of the CFV, the number of subjects in the B2D1C4 group who lowered their goals after failure was less than the number who responded similarly in the B1D2C2, the B3D1C2, and the B3D1C4 groups. On Trial 13 of the RLN, in the category of subjects who raised their goals after success, there were fewer subjects in the B2D2C3 group than there were in the B1D2C1 and B2D1C1 groups. In general, over all trials on all tasks, the subjects tended most often to raise their goals after success and to lower them after failure.

Summarized below is the evidence related to the questions cited previously about the effects of the conditions of reinforcement on the level of aspiration behavior of the subjects. The evidence pertinent to the absolute, positive, and negative goal discrepancy scores refers to relationships among the overall means, among the trends of means over the several sections of trials, and among the means on the last section of trials and those of the preceding sections. The evidence about change of direction refers to the frequency of subjects in the several cells who changed their goals in the various directions on each trial after they received success or failure information.

What is the effect of the orientation condition on level of aspiration behavior? The subjects who received reinforcement information framed within the individual and group orientations did not differ in terms of the sizes of their goal discrepancy scores or the directions in which they altered their goals after success or failure; neither group differed from the control group who only set goals and received performance information. What is the effect of the type-frequency condition on level of aspiration behavior? In terms of both aspects of level of aspiration behavior, the groups who received the several frequencies of success and failure information did not differ among themselves or from control subjects who only set goals and received performance information. Is there an interaction effect of the conditions of reinforcement on level of aspiration behavior? The groups of subjects who received the several combinations of reinforcement information did not respond differently in terms of the two measures of level of aspiration behavior. Does a terminal change in type-frequency of reinforcement information affect level of aspiration behavior? The subjects who received the change in type-frequency information did not respond differently from subjects who previously had received different frequencies of success and failure, from control subjects, or from the manner in which they had responded previously. Do subject and task variations influence the effects of the conditions of reinforcement on level of aspiration behavior? There were no systematic differences attributable to variations in subject or task characteristics. Generally, the subjects tended to set their goals fairly close to the performance level reported to them. After they received success information, the majority tended to raise their goals; after they received failure information, to lower them. There were exceptions in the sense that a few differences occurred. However, these differences were isolated and unsystematic and would not support generalizations about consistent influences.

The dearth of previous information pertinent to the effects. conditions of reinforcement on level of aspiration behavior was mentioned earlier. However, the results relevant to the influence of incentive-reinforcement, subject, and task variations are not consistent with the relationships implied in the discussions by Jucknat (47), Sears (68), and Anderson and Brandt (4). It would seem that applicable here is the discussion of explantory factors related to the effects of incentive-reinforcement variations on learning performance.[1] These comments will not be reiterated at this point but it is maintained that they are similarly pertinent to the relationships among the measures of level of aspiration behavior. Therefore, on the basis of the data accrued in the course of this study, the following general conclusions related to the goal discrepancy scores and changes of direction of goals appear warranted: subjects who receive the several reinforcement conditions, either singly or in combination, do not differ from control subjects who only set goals; subjects who receive the several variants of each of the reinforcement conditions do not differ among themselves; subjects who receive a change in type-frequency information do not respond differently from the manner in which they responded previously, or from the manner in which subjects who receive different frequencies of success and failure on previous trials or control subjects respond; on verbal and non-verbal tasks dimensionalized according to complexity, subjects do not respond differently to the conditions of reinforcement; on any one task or on the several tasks, subjects who differ in terms of intelligence level and, to some extent, level of academic achievement (and it is assumed past history of academic success and failure) respond in a similar fashion to the several reinforcement conditions. Again, these generalizations are limited to subjects and to situations and procedures similar to those utilized in the present study; the limitation related to the time factor must be stressed.

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[1] *Supra*. pp. 220, 223 and 224

Goal Discrepancy Scores--Conditions of Reinforcement Held Constant[1]

Subjects engaged in the goal setting process may react in several ways. Two aspects of the relationship between reported performance levels and stated goals were identified as being of interest: viz, the goal discrepancy score and the direction in which a goal is altered after attainment or non-attainment of a previous goal. Historically, there has been concern about the isolation of determinants of characteristic level of aspiration reactions. In the immediately preceeding section, questions were raised about the effectsof variations in incentive-reinforcement conditions (and related to these the influence of subject and task variations) on the two facets of the goal setting process. Herein, the focus is upon the influence of subject variations and task variations on the sizes of the goal discrepancy scores when the conditions of reinforcement are held constant. That is, the problem pertains to the relative sizes of the goal discrepancy scores of subjects who are similar in terms of mental maturity but different in terms of level of intelligence and, it is assumed, experiential background related to school situations and school-like tasks and to the consistency of the observed relationships among the six tasks.

Pertinent research includes that related to the role of academic achievement and previous school history and to the role of differences in intelligence level. Generally, the work of Uematsu (88), Shaw and Bensberg (70), and Walter and Marzolf (91) indicated a null relationship between sizes of goal discrepancy scores and intelligence test and/or achievement test scores. On the other hand, Sears (68) extensively discussed differences related to some tasks in the sizes of goal discrepancy scores of subjects who were considered to differ in terms of previous success and failure experiences related to school activities. Thus, conflicting points of view exist. It would seem reasonable to suppose that individuals who differ markedly in terms of intelligence level also differ in terms of previous history of success and failure in school or school-like activities. In this study, attempts have been made to utilize school-like situations, larger numbers of subjects, and subjects who differ more markedly in terms of level of intelligence. Therefore, the primary questions for scrutiny herein become these: Do the subjects in the three intelligence groups differ in terms of the sizes of their absolute goal discrepancy scores, negative goal discrepancy scores, and positive goal discrepancy scores? What is the influence of task characteristics on these differences; i.e., are the relationships observed consistent when the characteristics of the tasks in the verbal and non-verbal series differ along a complexity dimension?

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[1] It is a pleasure to acknowledge that many of the ideas and pertinent investigations cited in the ensuing discussion in this section were suggested by James R. Lent. Especially, Dr. Lent first pointed out to the writer the issues related to the generality of success and failure feelings and the influence of task ambiguity. The writer, of course, assumes responsibility for any errors implicit in her particular interpretation of these ideas.

In addition, there are available data which pertain, to some extent, to another problem. This investigation was not designed specifically to study this problem; nevertheless, the topic and data will be presented with the intent of perhaps isolating issues for scrutiny in subsequent investigations. Essentially, the question is this: What is the effect of repetition on subjects' goal discrepancy scores when the conditions of reinforcement are held constant? To state the issue in more behavioral terms--What is the effect of practice, or experience, in setting goals on the subjects' goal setting behavior? Related points of interest are the roles of variations in task characteristics and subject characteristics in this process. This is an important problem. Yet, no previous evidence related to this problem was located. However, it is logical to suppose that, other factors being constant, as subjects make a number of provisional tries, and become aware of the levels of performance on a given task which they can expect of themselves, the pattern of and, perhaps, accuracy of their goal setting behavior would become consistent. That is, whatever mode of response or pattern they adopt (high positive, low positive, etc.) they would continue in it with little deviation attributable to inaccuracy of performance expectations.

The evidence pertaining to questions about relative goal discrepancy scores and the effect of repetition is presented below and in Table 110. On each of the six tasks, non-significant F ratios were associated with the B factor related to the absolute, the positive, and the negative goal discrepancy scores. These data would seem to indicate that for all three goal discrepancy scores the retarded, normal, and superior groups of subjects had equivalent means. Consequently, there was consistency in this respect among tasks.

On the DLV, RLV, and CFN, the sizes of the subjects' absolute, positive, and negative goal discrepancy scores remained the same over the four sections of trials. This was not entirely the case on the CFV, DLN, and RLN. On these tasks, the goal discrepancy scores differed over the sections of trials, and as might be expected, these differences were not the same for the three measures. The absolute scores on the RLN were larger in the first section of trials and then remained equivalent in the remaining trials. The positive scores were larger in the first section, were equivalent in the two differential reinforcement sections, and then became smaller in the fourth section than

TABLE 110

COMPARISON OF THE GROUPS IN TERMS OF GOAL DISCREPANCY SCORES (CONDITIONS OF REINFORCEMENT HELD CONSTANT): SUMMARY OF RELATIONSHIPS APPARENT AMONG MEAN ABSOLUTE, POSITIVE, AND NEGATIVE GOAL DISCREPANCY SCORES

	Response Measure	Tasks--Probability of F					
		DLV	RLV	CFV	DLN	RLN	CFN
Trials (A)	G.D. Ab.	N.S.	N.S.	N.S.	.001[a]	.001[b]	N.S.
	G.D.+	N.S.	N.S.	.001[c]	.001[d]	.001[e]	N.S.
	G.D.-	N.S.	N.S.	.001[f]	N.S.	.001[g]	N.S.

[a] A1>A2; A1>A3; A1>A4; A2=A3; A2=A4; A3=A4.

[b] A1>A2; A1>A3; A1>A4; A2=A3; A2=A4; A3=A4.

[c] A1<A2; A1<A3; A1=A4; A2=A3; A2=A4; A3=A4.

[d] A1=A2; A1=A3; A1>A4; A2=A3; A2>A4; A3>A4.

[e] A1>A2; A1>A3; A1>A4; A2=A3; A2>A4; A3>A4.

[f] A1=A2; A1=A3; A1=A4; A2=A3; A2=A4; A3>A4.

[g] A1<A2; A1<A3; A1<A4; A2=A3; A2=A4; A3>A4.

	Response Measure	Tasks--Probability of F					
		DLV	RLV	CFV	DLN	RLN	CFN
Intelligence Level (B)	G.D.Ab.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.+	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.-	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Intelligence Level x Trials (BA)	G.D. Ab.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.+	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	G.D.-	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

they had been in the three previous sections. On the other hand, the negative scores became larger in the second and third sections in which they remained equivalent; and although they diminished in the fourth section, they remained larger than they had been in the first section. On the DLN, the absolute scores were larger on the first section and then remained equivalent thereafter (this pattern was apparent also in the absolute scores on the RLN); the positive scores remained equivalent until the fourth section of trials in which they became smaller than they had been on the preceding sections. The positive goal discrepancy scores for the CFV became larger on the second section of trials and remained equivalent thereafter. The negative scores on this task were homogenous in all but one comparison: the scores in the third section were larger than those in the fourth section. The absolute scores on the CFV and the negative scores on the DLN did not change over trials. It follows from this evidence that there was not complete consistency among the six tasks.

A further point of interest is the possibility that the retarded, normal, and superior groups responded differently over trials insofar as the sizes of the three types of goal discrepancy scores are concerned. On none of the six tasks were significant F ratios associated with the BA interactions for the absolute, positive, and negative goal discrepancy scores. As such, there was consistency among tasks.

The above evidence may be summarized as follows. The retarded, normal, and superior subjects did not differ in terms of the sizes of any of the goal discrepancy scores related to each of the six tasks. In some comparisons, the sizes of the goal discrepancy scores of the total group of subjects differed over the four sections of trials. Subject variations were not related to these changes; in addition, there was no indication that task characteristics were related systematically to the changes either.

The first set of questions relates to the influence of subject variations and task variations on the sizes of the goal discrepancy scores. According to the data, these variations exerted no influence insofar as the absolute, positive, and negative goal discrepancy scores were concerned. This evidence is consistent with the results reported by Uematsu (88) and by Walter and Marzolf (91) and inconsistent with the comments made by Sears (68). Differences among criteria for selecting subjects and among tasks utilized might contribute to an understanding of the discrepancies among results. However, before considering these points it perhaps would be helpful to reiterate aspects of the several investigations.

Uematsu and Walter and Marzolf evaluated the relationship between subjects' academic achievement test scores and their absolute goal discrepancy scores. Respectively, the level of aspiration tasks employed were the addition of columns of inverted numbers and the Rotter Aspiration Board. In both studies, the subjects generally were selected from a cross-section of the school population. In neither study was there isolated a significant relationship between the academic achievement and level of aspiration measures. Sears' subjects were chosen specifically on the basis of their school histories of success and/or failure in reading and/or arithmetic, and they set goals in relation to performance on reading and arithmetic tasks. In a neutral condition (no experimentally manipulated success or failure), her total success and total failure groups differed in terms of positive and negative goal discrepancy scores related to reading achievement and did not differ in terms of these measures related to arithmetic achievement; i.e., the subjects showed similarities and differences and these were related to the type of task on which they were performing. On the other hand, her differential group (success in reading--failure in arithmetic) did not differ from either group on either task.

Consider now the explanatory factors. Range, or homogeneity-heterogeneity, of scores can be an important factor in identifying non-null relationships. On the academic achievement variable, the ranges of scores made by Uematsu's and Walter and Marzolf's subjects probably were not as extreme as those made by Sears' subjects for whom this was a selection variable. On the other hand, in the present study, the subjects differed markedly in terms of the selection variable, intelligence, and, as it happened, to some extent in terms of reading achievement. Consequently, contradictions are apparent here and, in general, with the data available, it is difficult to assess the importance of this factor.

Another more obvious and, perhaps, more crucial point to be considered in an attempt to resolve this problem of inconsistent results is this: the goals set by Sears' subjects were for tasks reflecting the specific area in which they experienced previous success and failure; this was not the case in the present investigation and the two other investigations. There is implied here a specificity of the effects of previous experiences of success or failure;[1] i.e., that attitudes related to success or failure experiences influence performance only in those situations in which the success or failure occurred and do not generalize to other related or unrelated situations. Yet, the observation that Sears' total success and total failure groups did not differ in terms of goal discrepancy scores related to an arithmetic task and that neither of these groups differed on either task from the differential group complicates the specificity suggestion. There is another possibility. Perhaps, there is a relationship between generalized feelings of success and failure and goal setting behavior related only to certain tasks. Such a possibility involves this argument. Successful reading achievement in this culture receives a great deal of attention and emphasis; for arithmetic, this might not have been the case in the late 1930's when Sears' work probably was done. Granting this, it may be suggested that Sears' failure group was more concerned about a reading task than about an arithmetic task and thus were disturbed in setting goals related thereto. Not inconsistent with this idea is the observation that Uematsu's group[1] (who did not differ extremely in terms of the selection variable) did not differ in terms of goal discrepancy scores related to an arithmetic type task, or that Walter and Marzolf's group (who also did not differ extremely in terms of the selection variable) did not differ in response to the Rotter Aspiration Board, or that in the present study groups (who differed more extremely in terms of the selection variable) did not differ in goal discrepancy scores related to tasks which, while they certainly involved some of the elements of reading and arithmetic performance, ostensibly did not involve reading and arithmetic as they commonly are encountered in the classroom by children who have the chronological ages samples. However, inconsistent with this aspect of the specificity suggestion is the observation that Sears' differential group did not differ from her other two groups insofar as their goal discrepancy scores were concerned. If they had generalized feelings of success, they should have differed from the failure group; conversely, if they had generalized feelings of failure, they should have differed from the success group. Perhaps, they had intermediate feelings of success or failure and goal discrepancy scores in the intermediate range and Sears' statistical tests simply were not powerful enough to detect more intermediate differences which might have obtained. There is not enough evidence to decide which of these possibilities is tenable. The results of Lent's (52) work are pertinent to this problem. He compared the level of aspiration responses of mentally retarded subjects enrolled in special classes with those of mentally retarded subjects enrolled in non-special classes. He considered these groups of subjects to be dissimilar in terms of experiences of success and failure. On both an arithmetic type task and a reading type task, his subjects did not differ in terms of the indices of level of aspiration behavior he employed.

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[1] See Lewin et al. (54) for a discussion of the theoretical aspects of the generality hypothesis and for a review of several pertinent investigations.

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[1] However, it must be remembered that Uematsu employed post World War II Japanese children as subjects and the role of the cultural factor here is unknown.

In general, it may be that subjects who differ in terms of previous experiences related to success and failure do vary in response to activities which involve setting goals; it is reasonable to believe that this would be the case. However, the preponderance of evidence so far accrued in investigations in which children are employed as subjects does not tend to substantiate this expectation. Admittedly, there are limitations in the research pertinent to this topic and more investigation is needed; on the other hand, there is a consistency in the results of several investigations. Therefore, in view of all of these considerations, it would seem that at the present time there is no reason to believe that subjects who differ in terms of level of intelligence, and it is assumed previous histories of success and failure related to academic activities, differ in terms of the sizes of the discrepancies between their set goals and their reported performance levels on a number of learning tasks.

The next topic for discussion pertains to the effect of repetition on the sizes of the goal discrepancy scores and the influence of subject and task variations on this effect. It might be helpful first to consider separately the three aspects inherent in this topic: the effect of repetition, the role of task variations, and the role of subject variations. The evidence pertaining to all three aspects is less than conclusive. The data related to the role of repetition may be summarized as follows. On three of the six tasks, no changes in the sizes of goal discrepancy scores occurred with repetition; on three, changes occurred. The RLN was the first task administered. Here, there were changes in all three types of goal discrepancy scores. On the first section of trials (which involved only one goal discrepancy score), the absolute and positive goal discrepancy scores were larger than they were on the latter sections; after the first section, these measures remained constant. The negative goal discrepancy scores became larger after the first section, remained the same on the next two sections, and then became smaller on the fourth section. Thus, to some extent, with repetition there was a diminution of the absolute and positive scores indicating an alteration of the goals in the direction of proximity to the performance levels. On the whole, this was not true for the negative scores. If this had not happened with the negative scores, these results might have been supportive evidence for the idea that with repetition subjects set goals more consistent with their performance levels. Yet, there is other vitiating evidence. The remaining tasks were administered in a fairly irregular order. It would seem that if the subjects had learned to set consistent goals on the RLN, minimal differences in goal discrepancy scores among trials would have occurred on the remaining tasks. There were differences on some of the remaining tasks. On the other hand, if it were necessary on each task for the subjects to learn to gauge levels of performance in relation to goals, then differences might have been expected between the initial and latter trials on each of the tasks. This did not happen consistently on all of the remaining tasks.

Now consider the influence of variations in task characteristics. The differences which did occur (on the CFV, DLN, and RLN) were not systematic insofar as the complexity dimension or the dichotomy between verbal and non-verbal tasks were concerned. Yet, perhaps operating here is another set of task characteristics which might be influential in guaging successfully the relationships between performance levels and goals; that is, consistent performance expectations are implied in consistent goal discrepancy scores in the sense that the subject sets goals in terms of the levels of performance he expects to attain. Sutcliff (76) has suggested that task ambiguity is an important factor pertinent to this relationship and that such ambiguity is reflected in performance variability. In other words, on some tasks, performance is more amenable to control, or structured (less variable), and the subject has a more consistent basis for predicting how he will perform; on other tasks, performance cannot be so structured or controlled (more variable) and the subject cannot predict with the same accuracy. On an a priori basis, there is no reason to believe that the tasks utilized herein on which the subjects showed changes in goal discrepancy scores over trials differed in terms of such ambiguity from those on which the subjects did not show changes. In addition, an examination of the appropriate data (variances related to the attainment time measures, A) revealed that performance variability was present on all tasks--ostensibly no more so on the ones on which the goal discrepancy scores differed over trials than on the ones on which the goal discrepancy scores did not so differ. Further problematic relationships observed were these: for the three tasks on which discrepancies existed, the positive scores differed each time but the negative scores did not; also, although there was consistency from task to task in the patterns of changes, these patterns were not the same for the positive and negative scores.

Of interest next is the influence of variations in subject characteristics. The effect of repetition on changes in sizes of goal discrepancy scores is unclear. However, the evidence indicates that even when there were changes in sizes with repetition, subject variations did not operate to exert a differential effect. And, of course, subject variations did not operate in situations in which there were no changes in sizes.

As stated previously, the information about the role of repetition, practice, or experience in developing a consistent mode of response in setting goals in relation to performance levels pertains to an important question and no one apparently has presented systematic evidence related to the problem. This investigation was not designed specifically to examine this topic and consequently the evidence is tangential or indirect. As it happened, the data are inadequate. Therefore, it would seem inappropriate to suggest a conclusion. Further research related to this problem would be justifiable and helpful.

Performance on Intellectual Tasks--Conditions of Reinforcement Held Constant

It has been observed that retarded, normal, and superior subjects who are equated in terms of mental age can be regarded as being similar in terms of level of mental maturity but different in terms of levels of intelligence and chronological age and therefore such related factors as maturity of physical development and coordination, brightness, experiential background, and other important characteristics. Consequently, when concern is with the intellectual performance of these subjects, an essential question becomes this: Can expectations about intellectual performance be based upon mental age alone, or are they contingent upon a consideration of mental age in relationship to chronological age, intelligence quotient, the characteristics of the task, and the aspect of performance being evaluated? This question has been studied in several investigations in which a variety of tasks has been utilized; briefly, these tasks may be classified as psychometric tests, academic achievement tests, and tasks which involve more immediate learning. Some evidence has been accrued as a result of these investigations; yet, a number of issues remain unresolved. An attempt was made in this investigation to obtain further evidence related to these issues.

Psychometric Test Performance

Students of psychometric test performance sought to compare the subjects in terms of relative frequencies of success and failure on individual test items of a number of psychometric scales (9, 14, 20, 23, 24, 32, 46, 51, 56, 59, 60, 61, 78, 81, 90). In general, these investigators observed the following: retarded subjects tend to excel subjects who have higher intelligence quotients in performance on psychometric test items which involve motor manipulation and the use of information or knowledge acquired over a relatively long time span; on the other hand, subjects who have higher intelligence quotients tend to be superior to retarded subjects in performance on psychometric test items which are designed to elicit immediate rote memory, comprehension, reasoning, and response to more abstract concepts. In one of the latter studies of this problem, Thompson and Magaret (56, 81) employed the 1937 Revision of the Stanford-Binet Test of Intelligence. Of the investigations reported, this was about the most extensive and it represents a valuable contribution; however, it would seem that there are some difficulties for generalization which would bear further scrutiny.

Table 111 and the text below consist of information about the results obtained from analyses of psychometric test performance of the subjects employed in this investigation. Similarities and differences were apparent when the retarded, normal, and superior groups were compared in terms of the numbers of times they passed each of the subtests of the 1937 Revision of the Stanford-Binet Test of Intelligence, Form L. The normal and superior subjects differed in terms of response to one subtest; this was Reading and Report (Year X-3)--the normal passed less often. The retarded and normal subjects differed in terms of their responses to four subtests; so did the retarded and superior subjects. In comparison to the normal subjects, the retarded subjects more often passed Abstract Words (Year XI-3) and Vocabulary (Year XII-1) and less often passed Rhymes (Year IX-4) and Minkus Completion (Year XII-6); the frequencies of retarded and superior subjects passing these subtests were equivalent. In comparison to the superior subjects, the retarded subjects more often passed Making Change (Year IX-5) and less often passed Reading and Report (Year X-3), Finding Reasons (Year IX-4), and Similarities: three things (Year XI-6); the retarded and normal subjects did not differ in terms of the numbers passing these subtests.

In general, the number of differences isolated here is less than that reported by the investigators who utilized the 1908 and 1916 revisions of the Binet test and various other psychometric tests (9, 14, 20, 23, 24, 32, 46, 59, 60, 61, 78, 90). The differences among tests employed may contribute to an understanding of this lack of agreement among studies. In two studies in addition to this one, the 1937 Revision of the Stanford-Binet Test of Intelligence, Form L has been used; these were performed by Laycock and Clark (51) and by Thompson and Magaret (56, 81). Pertinent to the number of subtests on which differences were found, the results obtained herein agree more with those reported by Laycock and Clark who isolated three subtests on which differences occurred than with those reported by Thompson and Magaret who found the retarded and normal groups to differ on a large number of subtests. However, in both this study and the Thompson-Magaret studies, the normal and superior differed only in terms of one subtest; to this extent, the results of the studies are consistent. Among studies, there is little agreement related to the specific subtests on which differences occurred. The items on which there was agreement between this study and another about differences were these: Laycock and Clark, Making Change (Year IX-5)--retarded exceeded superior; Thompson and Magaret, Rhymes (Year IX-4) and Minkus Completion (Year XII-6)--normal exceeded retarded. On this point, there

TABLE 111

COMPARISON OF THE GROUPS IN TERMS OF INTELLECTUAL PERFORMANCE-- PERFORMANCE ON THE 1937 REVISION OF THE STANFORD-BINET TEST OF INTELLIGENCE, FORM L: SUMMARY OF RELATIONSHIPS AMONG FREQUENCIES OF SUBTEST SUCCESSES AND FAILURES

Subtest Number and Name	Comparison--Probability of the Critical Ratio[a]		
	B1:B2	B1:B3	B2:B3
IX-4 Rhymes	.01[b]	N.S.	N.S.
IX-5 Making change	N.S.	.01[c]	N.S.
X-3 Reading and report	N.S.	.01[d]	.01[e]
X-4 Finding reasons	N.S.	.01[f]	N.S.
XI-3 Abstract words	.01[g]	N.S.	N.S.
XI-6 Similarities: three things	N.S.	.01[h]	N.S.
XII-1 Vocabulary	.01[i]	N.S.	N.S.
XII-6 Minkus completion	.01[j]	N.S.	N.S.

[a] Probability levels greater than .01 are associated with the critical ratios yielded by the comparisons in terms of all subtests (within levels Year VI to Average Adult, inclusive) not cited herein.

also was little agreement between the results obtained by Laycock and Clark and those obtained by Thompson and Magaret. However, Laycock and Clark employed dull normal and superior subjects and thus their results are not comparable directly with those obtained in this study and in the Thompson and Magaret studies in which the retarded subjects had lower levels of intelligence. Actually, the point of departure for this aspect of the present study was primarily the data presented by Thompson and Magaret. Certainly, the results obtained here are inconsistent with those reported by these investigators. Several explanatory factors are pertinent; these relate to subject characteristics, sampling procedures, and numbers of subjects employed. Consider first subject characteristics. In the Thompson and Magaret studies and in this study, there were differences among the mental age, chronological age, and intelligence quotient ranges of the subjects: viz., mental age, two years six months to six years ten months versus about eight years six months to eleven years six months, respectively; chronological age, four years six months to sixteen years five months versus about twelve to eighteen years, respectively; intelligence quotient, 20 to 79 versus about 50 to 75, respectively. Among the more important implications of such heterogeneity is this: the subjects primarily were compared on different subtests. That is, in the younger mental age ranges characteristic of Thompson and Magaret's subjects, the nature of the subtests differed to some extent from the nature of those in the older mental age ranges characteristic of the subjects in this study. This relationship could be influential in producing discrepancies in the results of studies such as these. Evidence pertinent to this contention has been accrued in a number of investigations in which the orientation was somewhat different from that of the studies discussed here.[1] Consider second sampling procedures. Thompson and Magaret compared the responses of retarded subjects who, according to their report, were referred from a psycho-educational clinic to the responses of normal and superior subjects who were part of the standardization population for the test. In this study, all of the subjects were selected directly from public schools located within a fairly restricted geographical area. It is difficult to evaluate the influence of this difference in procedure; however, it is reasonable to believe that there may have been important concomitant characteristics of the several groups of subjects which could have operated to produce variations in results. Consider third numbers of subjects. The numbersof subjects employed by Thompson and Magaret in any one comparison were much larger than those employed in this investigation. As such, their statistical tests may be considered to have been more powerful or precise and finer differences may have been identified.

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[1] See especially the research cited by Thompson (83), Kuhlen (49), and Goodenough (36).

In summary, the results of this study basically are not in agreement with those of several other investigations in this area. The differences among the tests used in this and most of the earlier studies have been pointed out and several discrepancies among the methods used in this and the Thompson and Magaret study have been considered. These factors need to be evaluated in subsequent research; it is suggested especially that the nature of the test items in relation to the level of mental maturity be considered in a controlled and systematic fashion. At the present time, this generalization would seem tenable: retarded, normal, and superior subjects who have equivalent mental ages within the range eight years six months to eleven years six months do not differ consistently or systematically in terms of the adequacy of their responses to the subtests on the 1937 Revision of the Stanford-Binet Test of Intelligence, Form L.

Achievement Test Performance

The procedure utilized by investigators of relative achievement test performance was to compare the subjects in terms of level of academic achievement insofar as it is related to attainment of some products of school learning (8, 18, 21, 25, 46, 61, 62). These investigators reported that, as a rule, while the subjects perform with similar adequacy on achievement test items involving the mechanics or fundamentals of the several academic subjects, the subjects who have higher intelligence levels perform more adequately on items designed to elicit reasoning, comprehension, and response to more abstract concepts. The studies conducted by Cruickshank (18) and by Dunn (25) are among the more intensive investigations related to this topic. Cruickshank has pointed out (19) that these studies need to be extended by investigations in which are employed, among other things, larger numbers of subjects. Also, the relative status of intellectually superior subjects would bear further exploration.

In Table 112 appear data which reflect the performance of the subjects employed in this investigation on the reading subtests of the Upper Primary and Elementary Batteries of the California Achievement Tests, Form W. On both reading vocabulary and reading comprehension (and, it would follow, on total reading achievement), the retarded subjects performed less adequately than did the normal and superior subjects while these latter subjects performed with equivalent adequacy. The retarded group's mean reading vocabulary was approximately a year lower than the normal and superior groups' means. A similar statement can be made about mean reading comprehension grade placement.

The observation that normal subjects had a higher grade placement on reading comprehension than did retarded subjects is consistent with the results of other studies related to this matter; however, the presence of the same relationship when the

TABLE 112

COMPARISON OF THE GROUPS IN TERMS OF INTELLECTUAL PERFORMANCE-- PERFORMANCE ON THE READING SUBTESTS OF THE UPPER PRIMARY AND ELEMENTARY BATTERIES OF THE CALIFORNIA ACHIEVEMENT TESTS; FORM W:--SUMMARY OF RELATIONSHIPS AMONG MEANS OF GRADE PLACEMENT

Response Measure	Probability of F
Reading comprehension grade placement	.001[a]
Reading fundamentals grade placement	.001[a]
Total reading grade placement	.001[a]

[a] B1 < B2; B1 < B3; B2 = B3.

groups were compared in terms of reading vocabulary grade placement is not so consistent. In addition, questions may be raised in relation to the observation that while they exceeded the retarded subjects, the superior and normal subjects were similar in terms of both aspects of reading achievement. Explanatory factors are difficult to propose. In regard to the problems related to reading vocabulary, it may be that the processes involved here are more complex than those involved in the subtests employed in other studies to sample what is termed mechanics or fundamentals. In regard to the problems related to both reading vocabulary and the lack of differences between the normal and superior subjects, it would seem that the efficiency of the academic instruction received by the subjects might be considered and explored. Also, in some of the previous studies, the investigators have conducted much more extensive and intensive studies which included a greater variety of aspects of reading achievement and much more detailed scrutiny of specific functions. It could be that with more definitive measures the subjects employed here would have responded more in the expected manner. Further, it might be contended that the relationships observed here could be attributed to the administration of different test batteries to the subjects: the Upper Primary Battery was administered to the retarded group; the Elementary Battery, to the normal and superior groups. However, the retarded subjects did not appear to reach the ceiling of the Upper Primary Battery. The Elementary Battery was administered to the normal and superior subjects because it was considered that some of these subjects might reach the ceiling of the Upper Primary Battery. The legitimacy of evaluating the relative status of the groups in terms of scores attained on different batteries is contingent upon the belief that these batteries were standardized in such a fashion that the scores on the two instruments are comparable directly. If this belief is not tenable, then the meaning of the results is unclear. If it is tenable, then no problem exists. Teigs, et al. (80) state that the batteries were so standardized and that direct comparisons of the scores are possible. In the absence of contrary evidence, this statement is accepted and it is considered that the observed differences are valid ones. Consequently, this generalization would appear warranted: retarded, normal, and superior subjects who have equivalent mental ages (statistically controlled in this investigation) differ to some extent in terms of reading vocabulary and reading comprehension grade placement on the California Achievement Test, Upper Primary and Elementary Batteries, Form W; in terms of both aspects of reading achievement, retarded subjects perform less adequately than normal and superior subjects who, in turn, perform with similar adequacy.

Learning Performance

Investigators of relative learning performance concentrated on immediate or direct learning, retention of learning, and transfer of learning (13, 17, 45, 64, 73, 92, 93). Herein, the focus is upon direct learning and the primary interest is the further exploration of the influence of subject characteristics and the relationship between subject characteristics and task characteristics on performance adequacy. In general, pertinent results of previous investigations have been rather incomplete. A major difficulty has been the location of suitable learning tasks. Special attention was given to this difficulty during the development of the procedures for this investigation.

The material in Table 113 and the text below pertains to relative learning performance. The first problem relates to whether the subjects manifested improvement with practice or learning on the tasks. Learning did occur on all six tasks. For the verbal tasks, this learning was evident through the second section of trials of the DLV, through the fourth section of trials of the RLV, and through the third section of trials of the CFV; for the non-verbal tasks, through the fourth section of trials of the DLN, and through the third section of trials of the RLN and CFN. On all of the tasks, the response measure decrements were initially large and gradually became smaller over the sections of trials. This was the expected direction for scores reflecting the time and the number of responses necessary to supply the correct response.

The influence of intellectual variations is of concern next. The subjects in three intelligence groups showed both similarities and differences in terms of over-all mean level of learning performance attained on the tasks. On the verbal tasks, the differences varied somewhat along the complexity dimension. The groups performed with equivalent adequacy on the DLV. On both the RLV and the CFV, the retarded group performed less adequately than did the normal and superior groups while the two latter groups performed with similar adequacy. The differences among the groups on the non-verbal tasks did not vary along the complexity dimension; further, the relationships between the means were not the same for these tasks as they were for the verbal tasks. On each non-verbal task--DLN, RLN, and CFN--the performance of the retarded subjects was more adequate than that of both the normal and the superior subjects while the performance of the normal subjects was more adequate than that of the superior subjects.

TABLE 113

COMPARISON OF THE GROUPS IN TERMS OF INTELLECTUAL PERFORMANCE (CONDITIONS OF REINFORCEMENT HELD CONSTANT): SUMMARY OF RELATIONSHIPS APPARENT AMONG MEAN ATTAINMENT TIME AND NUMBER OF RESPONSES SCORES

	Response Measure	Tasks--Probability of F					
		DLV	RLV	CFV	DLN	RLN	CFN
Trials (A)	Att.	.001[a]	.001[c]	.001[e]	.001[g]	.001[h]	.001[i]
	No. R	.001[b]	.001[d]	.001[f]			

[a]A1>A2; A1>A3; A1>A4; A2=A3; A2>A4; A3=A4.
[b]A1>A2; A1>A3; A1>A4; A2=A3; A2>A4; A3=A4.
[c]A1>A2; A1>A3; A1>A4; A2>A3; A2>A4; A3>A4.
[d]A1>A2; A1>A3; A1>A4; A2>A3; A2>A4; A3>A4.
[e]A1>A2; A1>A3; A1>A4; A2>A3; A2=A4; A3=A4.
[f]A1>A2; A1>A3; A1>A4; A2>A3; A2=A4; A3=A4.
[g]A1>A2; A1>A3; A1>A4; A2>A3; A2>A4; A3>A4.
[h]A1>A2; A1>A3; A1>A4; A2>A3; A2=A4; A3=A4.
[i]A1>A2; A1>A3; A1>A4; A2>A3; A2>A4; A3=A4.

	Response Measure	Tasks--Probability of F					
		DLV	RLV	CFV	DLN	RLN	CFN
Intelligence Level (B)	Att.	N.S.	.001[a]	.001[c]	.001[e]	.001[f]	.001[g]
	No. R	N.S.	.001[b]	.001[d]			

[a]B1>B2; B1>B3; B2=B3. [b]B1>B2; B1>B3; B2=B3.
[c]B1>B2; B1>B3; B2=B3. [d]B1>b2; B1>B3; B2=B3.
[e]B1<B2; B1<B3; B2<B3. [f]B1<B2; B1<B3; B2<B3.
[g]B1<B2; B1<B3; B2<B3.

	Response Measure	Tasks--Probability of F					
		DLV	RLV	CFV	DLN	RLN	CFN
Intelligence Level x Trials (BA)	Att.	N.S.	.001[a]	.001[c]	.001[e]	.01[f]	.001[g]
	No. R.	N.S.	.01[b]	.001[d]			

[a]A1:B1>B2; B1>B3; B2=B3. A2:B1>B2; B1>B3; B2=B3. A3:B1>B2. B1>B3; B2=B3. A4:B1>B2; B1>B3; B2=B3.

[b]A1:B1>B2; B1>B3; B2=B3. A2:B1>B2; B1>B3; B2=B3. A3:B1>B2; B1>B3; B2=B3. A4:B1>B2; B1>B3; B2=B3.

[c]A1:B1>B2; B1>B3; B2>B3. A2:B1>B2; B1>B3; B2>B3. A3:B1>B2; B1>B3; B2>B3; A4:B1>B2; B1>B3; B2>B3.

[d]A1:B1>B2; B1>B3; B2=B3. A2:B1>B2; B1>B3; B2=B3. A3:B1>B2; B1>B3; B2=B3. A4:B1>B2; B1>B3; B2=B3.

[e]A1:B1<B2; B1<B3; B2=B3. A2:B1<B2; B1<B3; B2=B3. A3:B1<B2; B1<B3; B2=B3. A4:B1<B2; B1<B3; B2=B3.

[f]A1:B1=B2; B1<B3; B2<B3. A2:B1<B2; B1<B3; B2=B3. A3:B1<B2; B1<B3; B2<B3. A4:B1<B2; B1<B3; B2<B3.

[g]A1:B1=B2; B1=B3; B2=B3. A2:B1<B2; B1<B3; B2=B3. A3:B1<B2; B1<B3; B2=B3. A4:B1<B2; B1<B3; B2<B3.

The last problem is whether over the sections of trials the sizes of the differences among the means of the several groups were constant or equal.[1] This does not apply to the DLN performance; the means of the groups were homogeneous here. There was heterogeneity among the differences on the remaining five tasks. On the RLV and CFV, similar patterns of heterogeneity appeared. The patterns of heterogeneity on the RLN and CFN were similar to each other and different from those on the RLV and CFV. On the DLN, the pattern of heterogeneity differed from all of these. Consider first the RLV and the CFV. The normal and superior groups did not differ here in terms of displacement of means; this homogeneity remained constant over the four sections of trials. The retarded and superior subjects and the retarded and the normal subjects did differ in terms of displacement of means. The sizes of these differences did not remain constant over the four sections of trials: the differences on section one became larger on section two, became smaller on section three, and remained about the same on section four. This consistency was apparent even though the subjects' performance leveled off at about the third section on the CFV while no leveling off in performance occurred on the RLV and even though the BDA interaction was significant for the RLV but not for the CFV. Consider second the RLN and CFN. On both of these, the three groups differed in terms of displacement of means and these differences were heterogeneous over the four sections of trials. On both tasks, the differences on the first section of trials became smaller on the second section, then larger on the third section, and still larger on the fourth section. On both tasks, the groups tended to level off in performance after about the third section of trials. On the DLN, there was no leveling off in performance. Overall, the means of the groups differed in terms of displacement and the sizes of these differences were heterogeneous. In each comparison, the difference on the first section of trials became progressively smaller over the remaining three sections. It must be noted that the overall significant difference between the superior and normal groups diminished to non-significance when discrepancies at each section of trials were examined.

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[1] Other ways of stating this relationship would be these: the trends of the intelligence groups' means were parallel, the patterns of decrements were similar, the shapes of the learning curves were similar, or, behaviorally, the rates of learning were similar. When the null hypothesis was rejected, to localize statistically the points in the trial sequences at which the deviations in patterns occurred would have required further rather extensive statistical analyses. Such a localization was highly desirable but the additional time and expense involved were too prohibitive to make it possible at the present time. The next best solution seemed to be the following procedure: the differences between intelligence groups (B) at each section of trials (A) were evaluated statistically; the sizes of the differences from section to section were considered descriptively but not statistically. The inferential limitations of these descriptive analyses must be recognized. Generalization will have to await the results of appropriate statistical analyses.

All of the above information about learning performance may be summarized as follows. On all six tasks, learning occurred. In some cases, this learning was evident over the four sections of trials; in others, over only part of the trials. The subjects in the three intelligence groups showed both similarities and differences in terms of mean level of learning performance attained on the tasks. On the verbal tasks, the differences among means varied somewhat along the complexity dimension; on the non-verbal tasks, they did not. Further, the relationships among the means of the three groups were not the same for the verbal and non-verbal tasks. With the exception of the DLV on which there were no differences among groups, differences between the groups which did occur on the tasks were not equal or constant over the several sections of trials. Among tasks, the relationships among these patterns of differences were both similar and dissimilar.

Of concern first is the influence of subject characteristics on performance adequacy. Insofar as mean level of performance is concerned, the results of the comparisons reported herein relevant to the learning performance of retarded and normal subjects are not in disagreement with the results of previous studies. That is, retarded subjects performed more adequately on discrimination learning, rote learning, and concept formation tasks in which motor manipulation was at a maximum and overt manipulation of verbal symbols was at a minuminum. Normal subjects performed more adequately on tasks which involved primarily verbal learning of paired associate nonsense syllables. In addition, normal subjects performed more adequately on the tasks which tapped verbal concept formation; this point has been unclear in the past. The results of this study differ from the past evidence pertinent to parallellness of response means for the several trials (this has been designated behaviorally as rate of learning). No differences were found in other investigations; differences were found in this study. The reason for this discrepancy is difficult to propose. One major difference in the procedures of the previous studies and this one is the number of subjects involved. With the larger number of subjects employed in this study and consequently more precise statistical tests, differential responses over trials were apparent generally in situations in which the groups differed in terms of overall level of learning performance (45).

There has been a dearth of investigations in which superior and normal subjects and superior and retarded subjects have been compared in terms of learning performance. Generally, the following results were obtained in this study. The performance of superior subjects was less adequate than that of normal subjects and retarded subjects on discrimination learning, rote learning, and concept formation tasks in which motor manipulation, rather than verbal response, was at a premium. On primarily verbal tasks involving rote learning and concept formation, superior subjects performed more adequately than retarded subjects and with similar adequacy to normal subjects. When the superior group differed from the other two groups in terms of over-all mean level of performance, they also tended to differ in terms of the patterns of the discrepancies over the several trials.

In addition, the three groups of subjects were homogeneous in terms of mean level of performance, and therefore rate of learning, on the task involving verbal discrimination learning. No previous statistical results pertinent to this point have been cited.

All of these data would seem to support the idea that there is some relationship between certain subject characteristics and performance adequacy. Now consider the influence of task characteristics in this process. The subject characteristics varied were intelligence level and chronological age. Concomitant to these are several characteristics. The tasks were varied in terms of two characteristics: complexity and the extent to which primarily overt verbal or non-verbal responses were required.

On the non-verbal tasks, there was a highly positive relationship between chronological age and performance adequacy; level of intelligence and task complexity did not appear to be influential. That is, on all three tasks involving primarily non-verbal, motoric responses, the older retarded subjects performed more adequately than the younger normal subjects, and both groups performed more adequately than the still younger superior subjects. Conversely, on the verbal tasks, chronological age did not appear to be operant; instead, there appeared to be some positive relationship between level of intelligence and task complexity: to wit, on the discrimination learning task, the three groups performed with equivalent adequacy; on the rote learning and concept formation tasks, the retarded group performed less adequately than the normal and superior groups who, in turn, performed with similar adequacy.

These results are not inconsistent with past work pertinent to the topic and, to some extent, the evidence related to psychometric and achievement test performance reported herein. However, several limitations or problems must be suggested.

On the non-verbal learning tasks, chronological age rather than level of intelligence was the more influential subject variable and the task characteristic, complexity, did not affect this relationship. As stated, this is not inconsistent with other evidence on the matter; however, generalization must be limited. It is not known whether similar results would obtain if other systems of dimensionalizing according to complexity were used, if the tasks were more difficult, if the tasks involved more of the cognitive element, and/or if the subjects were required to search for correct responses by trial and error rather than to respond motorically while having a demonstration of the correct responses to rely upon as they did herein. These problems require further investigation.

When the verbal tasks are considered, it would seem that the relationship between task complexity and intelligence level tends to be influential in performance. Yet, it is difficult to determine what factor associated with intelligence level is important. Three factors--intellectual power, anxiety, and language facility--might be considered.

At this time, that brightness or intellectual power per se might be paramount is questionable because the normal and superior subjects did not differ from each other in terms of learning performance, achievement test performance, or, to any great extent, psychometric test performance. It could be that the influence of intellectual power would have been more obvious if the tasks had been more difficult or if a different system of dimensionalizing according to complexity had been used. It is difficult to decide this without further evidence.

It has been contended previously that in test situations, especially those involving verbal materials, retarded subjects, who often have had past experiences of failure in such situations, possibly experience anxiety related to anticipation of failure which might be detrimental to their performance while normal and superior subjects, who often have not had such failure experiences, do not succumb to these dynamics (7, 12, 66). Nevertheless, the data pertinent to the effect of reinforcement suggest that when the retarded subjects actually received failure information in the learning situation, their performance was not influenced detrimentally. They did not perform any less adequately than they had been performing previously or than retarded subjects who did not receive failure information; nor were they affected by failure any more than the normal and superior subjects. Consequently, the role of failure related anxiety cannot be given much weight insofar as the present data are concerned. However, this is a reasonable hypothesis and it would bear further exploration.

Language facility could have been influential. In situations in which they responded simply to words pertinent to topics with which they probably had had experience over relatively long periods of time, the retarded subjects performed quite adequately; on the other hand, when they had to employ verbal material in a new situation and/or in a relatively complex fashion, they did not respond as adequately as normal and superior subjects. Perhaps socioeconomic status as it was related to language development entered in. Generally, the subjects were selected from the same geographical area and marked differences in socioeconomic status did not seem apparent. Yet, some related factor may have influenced verbal performance. Here again, information is scarce and further study is needed.

In summary, the following generalizations would appear warranted. Intellectually retarded, normal, and superior subjects perform with similar adequacy on tasks involving primarily verbal discrimination learning. On primarily verbal tasks involving rote learning and concept formation, the performance of retarded subjects is less adequate than that of normal and superior subjects; the latter groups perform with similar adequacy. On primarily non-verbal tasks involving discrimination learning, rote learning, and concept formation, the performance of retarded subjects is more adequate than that of normal and superior subjects and the performance of normal subjects is more adequate than that of superior subjects. In situations in which there are differences in terms of mean level of performance, the shapes of the learning curves tend to differ.

When tasks are primarily non-verbal, chronological age is influential in performance adequacy and level of intelligence and task complexity are not. When tasks are primarily verbal, level of intelligence and task complexity are influential to some extent, and chronological age is not. These generalizations are limited to subjects and tasks similar in terms of relevant characteristics to those employed. There is a need for more investigations in which are employed different subjects and tasks, especially tasks which are more difficult and which are varied in other ways in terms of amount of verbalization involved and complexity. Also important is the need for further evaluation of the role of associated underlying factors such as motor facility, intellectual power or brightness, language facility, and others.

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CHAPTER V

SUMMARY

An important purpose of education involves the selection of experiences participation in which is conducive to the individual's achieving intellectually at a level commensurate with expectations based on his assessed capacity and to his becoming increasingly self-directed in such intellectual development. This purpose is not realized in some cases. In attempting to understand ~~this~~ failures, an examination might be made of several facets of the educational process, among them educational methodology. One basis of educational methodology is the manner in which individuals learn; therefore, study of the conditions of which learning is a function becomes crucial. In the present investigation, attention was centered on several aspects: to wit, the effects of selected conditions of reinforcement on learning performance and level of aspiration behavior, goal discrepancy scores with the conditions of reinforcement held constant, intellectual performance with the conditions of reinforcement held constant, and the influence of subject characteristics and task characteristics on each of these.

The basic experimental design involved three dimensions: intelligence level, orientation of reinforcement information, and type-frequency of reinforcement information. The intelligence dimension included three categories--retarded, normal, and superior. Overlapping within each of these categories were the reinforcement dimensions, orientation and type-frequency, by which were defined twelve subgroups of subjects (including appropriate control groups) combining to a total of thirty-six subgroups for the entire design. The subjects in each intelligence category were assigned randomly to the appropriate twelve subgroups.

Two hundred eighty-eight children--96 in each intelligence category--selected from the regular and special classes of the public schools were employed as subjects. An attempt was made to utilize subjects who were similar in terms of mental age and different in terms of chronological age and intelligence quotient. When the subject characteristics--mental age, chronological age, and intelligence quotient--were examined statistically, these relationships obtained. Over the total group of subjects, there were no differences in terms of any of these variables among subjects in the groups defined by the reinforcement dimensions, the groups defined by the combinations of these dimensions, or the groups defined by the combinations of these dimensions and the intelligence dimension. As expected, the three levels groups differed in terms of chronological age and intelligence quotient. In addition, while the retarded and normal groups were homogeneous in terms of mental age, both of these had lower mean mental ages than did the superior group. Within each intelligence group, the subgroups defined by the two reinforcement dimensions and those defined by the overlap of these did not differ in terms of mental age, chronological age, or intelligence quotient.

The six learning tasks represented as attempt to develop a verbal and a non-verbal series in each of which the tasks were varied along a dimension of complexity in terms of the number of and the relationship among the stimulus and response components involved. As a result, the six tasks included verbal and non-verbal tasks designed to involve respectively discrimination learning, rote learning, and concept formation and designated the discrimination learning verbal, the discrimination learning non-verbal, the rote learning verbal, the rote learning non-verbal, the concept formation verbal, and the concept formation non-verbal tasks. These were administered to the subjects in an irregular order. In addition, there were available data reflecting the subjects' performance on the 1937 Revision of the Stanford-Binet Test of Intelligence, Form L and the reading subtests of the California Achievement Test, Upper Primary and Elementary Batteries, Form W.

The reinforcement conditions, orientation and type-frequency, were administered within the framework of the level of aspiration paradigm. The orientation conditions included the individual orientation and the group orientation; the type-frequency condition, 100 percent success, 66 percent success--33 percent failure, 33 percent success--66 percent failure, and 100 percent failure. Arbitrary success and failure were employed in the appropriate cases. There were control subjects who set goals and received bona fide performance information and control subjects who only received performance information. All subjects were administered directions for speed and accuracy. In addition, a terminal change of reinforcement was employed with some groups.

During any one task administration, the incentive reinforcement information was administered to the experimental groups in three phases: a control phase in which the subjects received only performance information, a differential phase in which the subjects set goals and received the several frequencies of success or failure information within the individual or group orientation, and a terminal phase in which the subjects set goals and received 100 percent success information within the individual or group orientation. The level of aspiration control subjects received the control phase, and they set goals and received performance information in the latter two phases. The speed and accuracy control subjects operated under the conditions of the control phase throughout the task. From task to task, the subjects were administered different combinations of the reinforcement conditions.

The response measures employed were these: learning performance--(actual) attainment time and number of responses;

level of aspiration behavior--absolute (sign ignored), positive, and negative goal discrepancy scores, and number of times the subjects raised, lowered, or did not change their goals after success and after failure; psychometric test performance--number of times the subjects passed or failed the several subtest items; achievement test performance--grade placement. The statistical analyses included Bartlett tests of homogeneity of variance, analyses of variance, analyses of covariance, F tests of homogeneity of variance, t-tests, and critical ratios--differences between frequencies or proportions. The criterion for rejection of the null hypothesis was the .01 level of probability. In cases in which extreme heterogeneity of score variance was present, adjustments were made in evaluating the probability of the concomitant statistics related to differences among means.

A number of topics are involved in the three issues identified for investigation--effects of the selected conditions of reinforcement, goal discrepancy scores with conditions of reinforcement held constant, and intellectual performance with conditions of reinforcement held constant. Summarized below are the pertinent conclusions. These conclusions are based on the results of the statistical analyses presented in Chapter III and discussed in Chapter IV, information reported by previous investigators, and certain _a priori_ considerations.

Effects of Selected Conditions of Reinforcement

Effects of the Conditions of Reinforcement on Learning Performance[1]

Subjects who receive the orientation and type-frequency conditions of reinforcement do not differ in terms of mean level of learning performance or pattern of learning performance from control subjects who set goals and receive performance information or control subjects who only receive performance information. Subjects who set goals and receive performance information do not differ in terms of mean level of learning performance or pattern of learning performance from subjects who only receive performance information. Subjects who receive the group orientation and subjects who receive the individual orientation of reinforcement information do not differ in terms of mean level or pattern of learning performance. Subjects who receive the several frequencies of success and failure do not differ in terms of mean level or pattern of learning performance. There is no interaction effect of the orientation condition and the type-frequency condition on the mean level or pattern of the subjects' learning performance. The mean level of learning performance of subjects who receive a terminal change in type-frequency of reinforcement information does not differ from the mean level of performance of these subjects on preceding trials, of subjects who previously received different frequencies of success and failure, or of subjects in level of aspiration and speed and accuracy control groups. Task characteristics and subject characteristics do not influence the relationships cited above.

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[1] These statements pertain to both learning response measures: attainment time and, where appropriate, number of response scores.

These conclusions are inconsistent with conclusions based on the results reported by some previous investigators; they are consistent with conclusions based on research results cited by other investigators. To some extent, they vary from expectations based on a priori considerations. Proposed explanatory factors include characteristics of the reinforcement information, aspects of the task situation, nature of the control groups, and factors related to the administration of the tasks. These factors should be investigated further.

Effects of the Conditions of Reinforcement on Level of Aspiration Behavior

With a few appropriate alterations, the conclusions relevant to the effects of conditions of reinforcement on learning performance apply also to the effects of the conditions of reinforcement on the absolute, the positive, and the negative goal discrepancy scores. Subjects who receive the orientation and type-frequency conditions do not differ in terms of mean size, or change of size over trials, of the three goal discrepancy scores from control subjects who set goals and receive performance information. Subjects who receive the group orientation and subjects who receive the individual orientation do not differ in terms of mean size, or change of size over trials, of the three goal discrepancy scores. Subjects who receive the several frequencies of success and failure do not differ in terms of mean size, or change of size over trials, of the three goal discrepancy scores. There is no interaction effect of the orientation condition and the type-frequency condition on the mean size, or change of size over trials, of the three goal discrepancy scores. The mean size of the three goal discrepancy scores of subjects who receive a terminal change in type-frequency of reinforcement information do not differ from the mean size of the scores of these subjects on preceding trials, of subjects who previously received different frequencies of success and failure, or of level of aspiration control subjects. Subject characteristics and task characteristics do not influence the relationships cited above.

In the majority of cases, subjects tend to raise their goals after success and lower them after failure. Repetition, the conditions of reinforcement (orientation, type-frequency, and change of type-frequency information), subject characteristics, and task characteristics do not operate singly or in combination to influence this process differentially.

These conclusions are consistent with those based on the results of some previous investigations and inconsistent with those based on the results of other investigations. They agree with some a priori expectations and differ with others. Explanatory factors are the same as those cited in relation to the effects of conditions of reinforcement on learning performance; to wit, characteristics of the reinforcement information, aspects of the task situation, nature of the control groups, and factors related to the administration of the tasks. Here again, more research is needed.

Goal Discrepancy Scores--Conditions of Reinforcement Held Constant

Intellectually retarded, normal, and superior subjects do not differ in terms of the sizes of their absolute, positive, and negative goal discrepancy scores; task characteristics are not influential here either. These conclusions are both consistent and inconsistent with conclusions based on previously published reports and expectations based on a priori considerations. Proposed explanatory factors relate to the nature of the tasks, procedures, and samples of subjects employed. Further research is recommended.

Performance on Intellectual Tasks--Conditions of Reinforcement Held Constant

Psychometric Test Performance

Intellectually retarded, normal, and superior subjects who have equivalent mental ages within the approximate range 8-6 to 11-6 years do not differ consistently or systematically in terms of the numbers of times or the characteristics of the subtests they pass on the 1937 Revision of the Stanford-Binet Test of Intelligence, Form L. This conclusion differs, to some extent, from those based on previous research and expectations related to logical considerations. Suggested explanatory factors pertain to subject characteristics and procedural problems. It is recommended that further research include evaluation of the role of the age placement of the subtests being considered.

Achievement Test Performance

Intellectually retarded, normal, and superior subjects who have equivalent mental ages (statistically controlled in these comparisons) differ, to some extent, in terms of reading vocabulary and reading comprehension grade placement on the California Achievement Test, Upper Primary and Elementary Batteries, Form W. In both aspects of reading achievement, retarded subjects have a lower mean grade placement than normal and superior subjects who, in turn, do not differ in these respects. This conclusion is both consistent and inconsistent with those based on previous research and expectations based on logical considerations. It is suggested that the role of the effectiveness of academic instruction be scrutinized especially in further research.

Learning Performance[1]

Intellectually retarded, normal, and superior subjects perform with equivalent adequacy on a task involving primarily verbal discrimination learning. On primarily verbal tasks involving rote learning and concept formation, the performance of retarded subjects is less adequate than that of normal and superior subjects while the latter two groups perform with equivalent adequacy. On primarily non-verbal tasks involving discrimination learning, rote learning, and concept formation, the learning performance of retarded subjects is more adequate than that of normal and superior subjects and the learning performance of normal subjects is more adequate than that of superior subjects. In situations in which no differences occur between over-all mean level of performance, the shapes of the learning curves, of course, do not differ; in situations in which there are differences in terms of over-all mean level of performance, the shapes of the learning curves differ.[2] As far as they go, these conclusions are consistent with those based on the results of previous research. On ostensibly non-verbal tasks, in which performance is considered primarily to involve motor facility, chronological age is more influential in performance adequacy than intelligence level and task complexity. On ostensibly verbal tasks, the relationship between intelligence level and task complexity tends to be more influential in performance adequacy than chronological age. This conclusion is, to some extent, consistent with logical considerations and conclusions based upon the results of previous research. Much more investigation of this problem is needed. Such investigation should include, among other things, evaluation of the roles of different complexity dimensions and difficulty levels, and language facility.

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[1] Statements herein refer to both attainment time and, where appropriate, number of responses scores as measures of learning performance.

[2] Statistical evaluation of these differences was considered unfeasible in terms of the additional time, expense, and labor involved. Descriptive analyses were presented and it is suggested that further work be done utilizing statistical analyses.

Limitations

All of these conclusions are limited to populations similar to those from which the samples were selected, to aspects of behavior similar to those assessed, and to conditions or situations similar to those involved in this investigation.[1] Wider generalization is contingent upon further research. In addition, pertinent here are the following comments by Johnson and Blake about the applicability of information of the type accrued in this investigation to children's behavior in the classroom.

> Finally, it must be realized that the investigations reported herein and proposed are primarily theoretical in nature. For the purposes of experimental control, it was necessary that the task materials (and the manner in which they were manipulated) be of a type with which there was reason to believe that the subjects had not had specific prior experience and that certain related and highly important variables be regulated as much as possible. In addition, the circumstances related to the task administration cannot be considered to reflect the circumstances existing in a classroom. That is to say, the dynamics operating in the research situation and those operating in a classroom situation probably are not comparable directly. As a result, the generalizations emanating from investigations such as these are not applicable directly to academic learning within the classroom. Rather, they should be considered as basic data which should be extended or evaluated further in a parallel series of investigations in which are employed tasks and experimental conditions more representative of the average classroom situation (1, p. 153).

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[1] Also, the reader is reminded of the stringent criterion for rejection of the null hypothesis. He is encouraged to evaluate this issue for himself and make his own decision. It may be that the writer was too conservative.

APPENDICES

APPENDIX A

COOPERATING PUBLIC SCHOOL PERSONNEL

Baldwinsville, N.Y.

Mr. Theodore Durgee, Supervising Principal, Baldwinsville Central Schools

Baldwinsville High School

Principal: Mr. Donald W. Coats; Guidance Counsellor: Miss Mae E. Reynolds; Teacher: Mrs. Birt Evans

Elizabeth St. School

Principal: Mr. Joseph Ritter; Guidance Counsellor: Mrs. Alice Soule; Teachers: Mrs. Verona Dran, Mrs. Sarah Riddell, Mrs. Beverly Fuller, Miss Millie Ballon

Van Buren School

Principal: Mr. Leslie G. Eisenhour; Teachers: Mrs. Ruth Day, Mrs. Pauline Clarke

Camden, N.Y.

Director of Pupil Personnel Services: Mr. Robert Mills; School Psychologist: Mr. Calvin Mosher; Director of the Special Class Program: Mrs. Jane Andrews

Canastota, N.Y.

Mrs. Pauline Campbell, Elementary School Supervisor, Canastota Central Schools

Canastota Central School

Principal: Mr. William Pardee; Secretaries: Mrs. Jessie DeFazio, Mrs. Joseph Masucci; Teachers: Mrs. Nellie McPherson, Mr. Gerald Jones

East Syracuse, N.Y.

East Syracuse Junior--Senior High School

Principal: Mr. Stanley Zamory; Guidance Counsellor: Mrs Harriet Brown; Teacher: Mr. William Woznek

Heman Avenue School

Principal: Mrs. Dorothy Ward; Teachers: Mrs. Helen Boland, Miss Mary Engles

Liverpool, N.Y.

Mr. Frank Rhyner, School Psychologist

Liverpool Elementary School

Principal: Mr. James Dunn; Guidance Counsellor: Miss Margaret Heffernan; Teacher: Mr. Donald Turkonis

Oneida, N.Y.

Dr. Monroe Levin, School Psychologist

Castle Street School

Principal: Miss Mildred A. Ridley; Secretary: Miss Ruth Erdige; Teacher: Mrs. Fish

Seneca Street School

Principal: Mrs. Margaret H. Waters; Teacher: Miss Leona Felshaw

Marcellus, N.Y.

Miss Kathryn Heffernan, Elementary School Supervisor

Marcellus, N.Y.

Marcellus Elementary School

Secretary: Mrs. Dilys Kingsbury; Teachers: Mrs. Barbara Aldrich, Miss Helen Keenan, Miss Ann Holmes, Miss Rita Larkin, Miss Margaret Walsh, Mrs. Helen Eggerton, Mrs. Ava Frese, Mrs. LaVerne Mackin, Miss Patricia Coyne, Mrs. Barbara True, Miss Mary Ramsden, Miss Mary Hurtiger, Mrs. Sarah Wiggers, Mrs Margaret Shay, Mrs. Helene Bush

Rome, N.Y.

Mr. William G. Young, Director of Pupil Personnel Services; Mr. Joseph Wiseman, School Psychologist

Laurel St. School

Principal: Mr. Price Ackerman; Teachers: Mrs. Gwendolyn McClusky, Mrs. Margaret van Ness

Staley School

Principal: Dr. Wallace Luddin; Teacher: Mrs. Helen Prevo

Syracuse, N.Y.

Mr. David Sine, Assistant Director of Research; Miss Ina Cole, Supervisor, Education of Exceptional Children

Central High School

Principal: Dr. Edward Lang; Assistant Principal: Mr. George Berry, Teachers: Mrs. Harriet Chamberlain, Mrs. Dorothy Trewer

Charles Andrews School

Principal: Mr. Frank List; Secretary: Mrs. Theresa Pierce; Teachers: Mrs. Marion Barksdale, Mrs. Denise Donahue, Mrs. Virginia Morris, Mrs. Catherine O'Shea, Mrs. Leona Parker, Mrs. Evelyn Seavy

Syracuse, N.Y.

Delaware School

Principal: Mr. Kenneth J. Drake; Secretary: Mrs. Evelyn Zaleon; Teachers: Mrs. Irene Carlton, Mr. Joseph Gangemi, Mr. Harold Ginsberg, Mrs. Betty Wacherle

Edward Smith School

Principal: Mrs. Elsie Platto; Secretary: Mrs. Mildred Jones; Teachers: Miss Myra Mt. Pleasant, Mrs. Agnes Gorman, Mrs. Mary Schreck, Mrs. Louise Johnson, Mrs. Margaret Devereaux, Miss Vera Dexter, Mrs. Evelyn Schneider

Franklin School

Principal: Miss S. Marcella Jones; Secretary: Miss Marie Scully; Teachers: Miss Alice Thornton, Mrs. Florence Delge, Miss Mary Hargaden, Mrs. Lillian Padlin, Mrs. Beulah Stemler, Mrs. Florence Heddon

Fraser School

Principal: Mr. Thomas Ingraham; Teachers: Mrs. Marie Long, Mrs. Gwendolyn Donahue

Grant Junior High School

Principal: Mr. H.R. Peet; Secretary: Mrs. Claire Wescott; Teachers: Miss Kathryn Dwyer, Mr. George Jurik

West Genesee Central Schools, N.Y.

Mr. John F. Calvert, School Psychologist

Camillus Elementary School

Principal: Mr. Reid A. Pringle; Secretary: Mrs. True Wiegard; Teachers: Mrs. Ruth Edwards, Mr. Robert Fuge, Miss Clara Fenlon, Mrs. Evelyn Howell, Miss Helen Nagy, Mrs. Helen Neilson, Miss Arlene Sheldon, Mrs. Barbara Stanisley

West Genesee Central Schools, N.Y.

East Hill School

Principal: Mrs. Ruth Kearns; Secretary: Mrs. Arlene Jerry; Teachers: Mr. James Clark, Mrs. Marjorie Glassow, Mrs. Mabel Roberts, Mrs. Elizabeth Pfeuller, Miss Elaine Spencer, Mrs. Mary Jane Wise, Mrs. June Ponte

Onondaga Road School

Principal: Miss Louise Smith; Secretaries: Mrs. Anne Keegan, Mrs. Helen Wood; Teachers: Miss Joan Galvin, Miss Virginia Sullivan, Miss Nancy Connolly

Warners School

Principal: Mr. Reid Pringle; Secretary: Mrs. Gertrude Andreola; Teacher: Mrs. Joan Billington

APPENDIX B

SUBJECTS LISTED BY BASE CELLS:
SCHOOLS, MENTAL AGE, CHRONOLOGICAL AGE,AND INTELLIGENCE QUOTIENTS

	Subject Code Number	School Code Number	Mental Age (Months)	Chronological Age (Months)	Intelligence Quotient
BASE CELL 1: RETARDED GROUP	B1-8	1	117	154	76
	B1-60	7	110	196	61
	B1-42	20	104	171	63
	B1-49	20	109	171	66
	B1-51	19	124	194	69
	B1-55	14	136	182	75
	B1-81	7	116	178	68
	B1-138	9	134	190	75
BASE CELL 2: RETARDED GROUP	B1-2	9	119	181	69
	B1-17	5	124	199	69
	B1-25	12	112	163	70
	B1-110	15	115	173	69
	B1-118	19	128	197	71
	B1-120	15	118	186	67
	B1-123	4	105	151	70
	B1-144	12	118	165	73
BASE CELL 3: RETARDED GROUP	B1-16	14	130	185	74
	B1-40	7	111	181	64
	B1-54	7	101	183	58
	B1-61	14	132	176	78
	B1-75	14	126	194	70
	B1-76	2	109	148	74
	B1-97	7	114	174	68
	B1-128	7	112	177	66

	Subject Code Number	School Code Number	Mental Age (Months)	Chronological Age (Months)	Intelligence Quotient
BASE CELL 4: RETARDED GROUP					
	B1-5	4	104	163	65
	B1-153	1	124	183	71
	B1-26	19	128	183	74
	B1-34	20	110	151	73
	B1-45	14	110	194	61
	B1-64	14	132	190	74
	B1-90	12	117	152	77
	B1-96	15	120	162	75
BASE CELL 5: RETARDED GROUP					
	B1-73	7	111	187	63
	B1-78	14	124	177	73
	B1-117	12	109	163	68
	B1-112	19	108	172	65
	B1-135	15	119	168	73
	B1-14	17	100	166	62
	B1-58	14	132	191	74
	B1-70	12	102	157	65
BASE CELL 6: RETARDED GROUP					
	B1-7	15	103	150	69
	B1-13	9	117	156	75
	B1-27	1	125	171	75
	B1-29	15	102	152	67
	B1-33	14	116	176	69
	B1-66	19	110	166	67
	B1-80	13	114	167	70
	B1-131	14	126	194	70

	Subject Code Number	School Code Number	Mental Age (Months)	Chronological Age (Months)	Intelligence Quotient
BASE CELL 7: RETARDED GROUP					
	B1-1	7	108	182	62
	B1-44	5	116	229	64
	B1-77	9	108	161	68
	B1-83	14	112	195	62
	B1-86	7	121	171	73
	B1-91	14	122	177	72
	B1-116	7	118	172	71
	B1-151	14	141	193	78
BASE CELL 8: RETARDED GROUP					
	B1-15	1	115	163	71
	B1-52	4	114	174	68
	B1-53	14	130	190	73
	B1-79	1	126	184	72
	B1-100	1	105	158	67
	B1-105	12	118	158	75
	B1-137	19	107	164	66
	B1-142	1	113	181	65
BASE CELL 9: RETARDED GROUP					
	B1-39	14	128	191	72
	B1-63	9	103	164	64
	B1-101	17	114	174	68
	B1-108	19	134	195	74
	B1-114	4	121	165	75
	B1-124	7	118	185	67
	B1-126	4	114	166	70
	B1-130	1	107	145	74

	Subject Code Number	School Code Number	Mental Age (Months)	Chronological Age (Months)	Intelligence Quotient
BASE CELL 10: RETARDED GROUP					
	B1-22	19	128	179	75
	B1-23	4	118	175	70
	B1-35	1	111	162	69
	B1-47	17	101	142	71
	B1-74	15	131	188	74
	B1-119	2	114	196	63
	B1-133	9	122	184	70
	B1-154	17	113	168	69
BASE CELL 11: RETARDED GROUP					
	B1-21	2	110	155	71
	B1-30	4	100	173	60
	B1-59	4	118	173	71
	B1-87	19	124	176	73
	B1-89	7	114	189	64
	B1-98	14	134	190	75
	B1-111	7	106	182	61
	B1-127	19	125	172	75
BASE CELL 12: RETARDED GROUP					
	B1-24	7	107	181	62
	B1-28	13	115	154	75
	B1-31	19	120	187	68
	B1-43	1	116	177	69
	B1-62	7	125	180	73
	B1-68	14	132	177	78
	B1-72	1	109	165	67
	B1-139	12	104	153	68

	Subject Code Number	School Code Number	Mental Age (Months)	Chronological Age (Months)	Intelligence Quotient
BASE CELL 1: NORMAL GROUP					
	B2-14	7	123	118	104
	B2-19	1	109	102	107
	B2-46	16	103	110	94
	B2-55	12	120	115	104
	B2-60	7	121	113	107
	B2-66	16	133	118	113
	B2-83	7	124	114	109
	B2-86	16	99	113	88
BASE CELL 2: NORMAL GROUP					
	B2-29	9	129	123	105
	B2-4	9	129	117	110
	B2-12	12	108	106	102
	B2-16	9	134	122	110
	B2-58	12	111	114	97
	B2-74	16	96	95	101
	B2-85	1	118	108	109
	B2-92	1	127	114	111
BASE CELL 3: NORMAL GROUP					
	B2-11	16	138	127	109
	B2-13	16	105	117	90
	B2-26	16	120	127	95
	B2-45	7	128	128	100
	B2-70	12	105	115	91
	B2-72	1	117	113	104
	B2-77	8	112	101	111
	B2-97	6	112	109	103

	Subject Code Number	School Code Number	Mental Age (Months)	Chronological Age (Months)	Intelligence Quotient
BASE CELL 4: NORMAL GROUP	B2-7	12	109	105	104
	B2-20	3	114	120	95
	B2-32	3	99	90	110
	B2-39	12	123	110	112
	B2-64	16	111	108	103
	B2-65	7	127	116	109
	B2069	9	131	120	109
	B2-90	8	120	107	112
BASE CELL 5: NORMAL GROUP	B2-31	16	102	99	103
	B2-35	8	134	135	99
	B2-44	16	108	102	106
	B2-50	3	126	113	112
	B2-52	7	119	111	107
	B2-57	6	113	113	100
	B2-76	16	120	112	107
	B2-91	16	112	113	99
BASE CELL 6: NORMAL GROUP	B2-28	16	136	126	108
	B2-33	12	104	115	90
	B2-36	9	111	109	102
	B2-41	3	125	112	113
	B2-62	1	114	106	108
	B2-73	8	104	94	111
	B2-82	3	112	113	99
	B2-98	7	128	117	109

	Subject Code Number	School Code Number	Mental Age (Months)	Chronological Age (Months)	Intelligence Quotient
BASE CELL 7: NORMAL GROUP					
	B2-8	8	132	122	108
	B2-15	16	126	130	97
	B2-24	16	119	108	110
	B2-49	12	101	103	98
	B2-51	16	108	123	88
	B2-53	16	112	126	89
	B2-54	3	122	127	96
	B2-59	16	116	121	96
BASE CELL 8: NORMAL GROUP					
	B2-17	16	125	134	93
	B2-23	12	112	109	103
	B2-47	3	121	113	107
	B2-61	12	98	100	98
	B2-67	3	118	123	96
	B2-87	3	122	119	103
	B2-88	12	111	115	97
	B2-100	16	116	103	113
BASE CELL 9: NORMAL GROUP					
	B2-9	16	122	122	100
	B2-10	3	140	133	105
	B2-18	12	99	102	97
	B2-38	3	130	130	100
	B2-43	12	97	111	88
	B2-75	3	120	110	109
	B2-79	6	111	112	99
	B2-84	16	116	117	99

	Subject Code Number	School Code Number	Mental Age (Months)	Chronological Age (Months)	Intelligence Quotient
BASE CELL 10: NORMAL GROUP	B2-1	16	97	103	94
	B2-2	16	139	126	110
	B2-6	16	129	114	113
	B2-30	12	103	109	94
	B2-48	9	121	113	107
	B2-63	8	132	132	100
	B2-71	16	107	118	91
	B2-94	16	109	98	111
BASE CELL 11: NORMAL GROUP	B2-3	16	126	124	102
	B2-5	1	111	116	96
	B2-22	6	113	104	109
	B2-25	7	119	114	104
	B2-40	16	110	116	95
	B2-56	16	112	118	95
	B2-80	16	118	131	90
	B2-96	16	125	123	102
BASE CELL 12: NORMAL GROUP	B2-21	16	111	119	93
	B2-27	3	126	126	100
	B2-34	16	108	103	105
	B2-37	16	100	99	101
	B2-68	16	129	118	110
	B2-78	16	110	114	88
	B2-89	16	112	115	97
	B2-93	3	139	123	113

	Subject Code Number	School Code Number	Mental Age (Months)	Chronological Age (Months)	Intelligence Quotient
BASE CELL 1: SUPERIOR GROUP	B3-6	18	134	103	130
	B3-13	6	134	109	123
	B3-21	10	132	101	131
	B3-25	6	131	103	127
	B3-40	16	118	97	122
	B3-42	3	106	88	120
	B3-56	10	125	93	136
	B3-62	6	130	103	126
BASE CELL 2: SUPERIOR GROUP					
	B3-7	8	112	87	129
	B3-24	10	115	93	124
	B3-31	8	118	95	124
	B3-44	16	137	106	129
	B3-54	8	135	100	135
	B3-65	8	132	108	122
	B3-86	8	135	103	131
	B3-91	10	140	105	133
BASE CELL 3: SUPERIOR GROUP					
	B3-18	16	122	100	122
	B3-68	16	131	99	132
	B3-70	16	117	91	128
	B3-73	8	126	98	129
	B3-78	8	113	86	131
	B3-80	6	137	112	122
	B3-89	8	132	108	122
	B3-98	6	132	109	121

	Subject Code Number	School Code Number	Mental Age (Months)	Chronological Age (Months)	Intelligence Quotient
BASE CELL 4; SUPERIOR GROUP					
	B3-5	10	139	115	121
	B3-9	18	127	101	127
	B3-10	8	120	89	135
	B3-35	8	122	90	136
	B3-53	16	133	88	151
	B3-55	7	118	97	122
	B3-76	10	119	86	142
	B3-87	6	133	105	127
BASE CELL 5: SUPERIOR GROUP					
	B3-2	1	137	113	121
	B3-27	8	129	99	130
	B3-30	3	113	87	126
	B3-49	10	116	88	132
	B3-58	1	140	117	120
	B3-59	8	124	101	123
	B3-72	16	122	101	121
	B3-95	18	140	101	139
BASE CELL 6: SUPERIOR GROUP					
	B3-8	10	119	98	135
	B3-16	3	137	96	143
	B3-33	18	119	98	122
	B3-50	3	112	88	127
	B3-57	16	126	86	147
	B3-67	12	121	98	123
	B3-75	6	140	113	124
	B3-85	3	137	116	118

	Subject Code Number	School Code Number	Mental Age (Months)	Chronological Age (Months)	Intelligence Quotient
BASE CELL 7: SUPERIOR GROUP					
	B3-22	18	119	97	123
	B3-23	8	115	85	137
	B3-32	3	136	100	136
	B3-34	16	115	89	129
	B3-61	6	134	107	125
	B3-66	6	140	109	128
	B3-90	16	122	101	121
	B3-96	8	135	107	126
BASE CELL 8: SUPERIOR GROUP					
	B3-43	8	116	99	117
	B3-45	10	131	90	145
	B3-46	3	118	86	137
	B3-52	9	138	117	118
	B3-71	10	123	105	117
	B3-92	6	132	108	122
	B3-93	8	129	102	126
	B3-103	6	138	107	130
BASE CELL 9: SUPERIOR GROUP					
	B3-14	18	133	104	128
	B3-17	18	124	97	128
	B3-29	16	119	95	125
	B3-38	3	129	87	148
	B3-41	8	120	100	120
	B3-48	16	136	94	145
	B3-77	8	140	94	149
	B3-83	10	117	90	130

	Subject Code Number	School Code Number	Mental Age (Months)	Chronological Age (Months)	Intelligence Quotient
BASE CELL 10: SUPERIOR GROUP	B3-3	3	138	101	137
	B3-47	8	124	103	120
	B3-60	3	105	90	117,
	B3-102	6	138	97	155
	B3-74	6	132	109	121
	B3-81	16	115	93	124
	B3-82	8	139	105	132
	B3-100	8	103	75	137
BASE CELL 11: SUPERIOR GROUP	B3-4	6	137	113	121
	B3-11	3	127	87	146
	B3-12	10	110	89	124
	B3-15	8	132	98	135
	B3-28	18	118	98	120
	B3-69	8	115	90	128
	B3-94	10	132	96	138
	B3-97	10	139	91	153
BASE CELL 12: SUPERIOR GROUP	B3-1	3	123	94	132
	B3-20	18	134	107	125
	B3-36	18	127	106	120
	B3-37	6	119	99	121
	B3-51	6	135	105	129
	B3-64	16	122	92	133
	B3-79	16	121	93	130
	B3-99	16	131	93	141

APPENDIX C

THE DISCRIMINATION LEARNING VERBAL TASK: MATERIALS, CONSTRUCTION, PROCEDURE, AND DIRECTIONS

Materials

Presented below are the 72 combinations of cue words and alternates arranged according to the order in which they were presented to the subjects. (In the actual presentation each item was typed on a separate card.)

Example:

A.	fespon	efkomz	sonkax	caysef	poslug
B.	fespon	zestor	topfub	krifon	nasyoc
C.	fespon	tesamp	klofyn	nusdeg	kloafs
D.	fespon	byosan	enkrox	puforg	sohezb

Trial Number	Item	Cue Word	Response Alternates			
1	A	brafen	bwadex	bavguf	jaxemb	wahenj
	B	gitsum	bivsrt	kygmrs	wospum	gmidav
	C	kovjel	nakjoq	wekajy	vaxkeh	brokyl
2	A	gitsum	tucjin	gymcun	grubix	sibmoz
	B	kovjel	lanjuk	dijzoe	qhoven	pijwok
	C	brafen	cnubex	grezaw	anbivs	facung
3	A	kovjel	wajkyv	jrskod	holezg	jodvaz
	B	brafen	rehboq	nadrum	nujfez	nehawn
	C	gitsum	gnihsy	gatemp	gavsij	mujinx
4	A	kovjel	gerzjo	kedohm	lykbaj	vegkuh
	B	gitsum	mugdyx	tvuseq	qigmow	wugmax
	C	brafen	rifuvb	pobnrs	canpex	barpoz
5	A	gitsum	husorg	zigsec	ghetuk	gehmuj
	B	brafen	nerizg	pabnuz	cerymf	adrybz
	C	kovjel	romkes	vujemb	vonkim	qerlox
6	A	brafen	rinham	farwiq	brahom	berpos
	B	gitsum	hispun	migcax	pmikat	huvgos
	C	kovjel	vnewrl	gijver	wogkec	gukjav
7	A	gitsum	dixguv	midzuv	hicumz	ditmox
	B	brafen	frawyh	kydnar	subenq	radcem
	C	kovjel	cosljn	dakomv	ojriks	rhevob
8	A	brafen	rybnov	nosfrj	myrbez	gerdny
	B	kovjel	qijkuv	krevuc	jbewml	navzoe
	C	gitsum	gidurn	vumysq	qimjas	wigdyt
9	A	kovjel	erjavp	licjow	zevhik	nrkveg
	B	brafen	zemnif	krejnx	juranx	arnjip
	C	gitsum	dixpug	myrsud	tramuj	sybgem
10	A	brafen	junbav	vibarg	nibroc	gdefax
	B	gitsum	gbytuh	wazgus	jupdig	esinux
	C	kovjel	jiscoe	jeqomn	pexojs	lepkih
11	A	gitsum	gomsib	pogimb	cagvis	tsicnj
	B	kovjel	sijkeh	vlecax	vpehox	qexork
	C	brafen	bgersk	binjax	fyronk	qedanv
12	A	kovjel	yiksoj	zovkuc	woknuv	jivaxl
	B	gitsum	qigmaj	kwimvt	kumwij	zibmeg
	C	brafen	nyrisb	wendaq	girbaw	bwinsf

13	A	kovjel	osgavj	vloniq	wavjyk	vabdej
	B	gitsum	twegsd	bamgir	secguk	kymgix
	C	brafen	nirhek	cegnaj	fumbor	abrodz
14	A	gitsum	sikgav	jukipt	supweg	cogump
	B	brafen	sekamb	nabcop	macdep	revpyf
	C	kovjel	yohesk	secvyl	krowez	povjyd
15	A	brafen	wobrin	knofaq	kebnys	coranz
	B	gitsum	mihsez	gusmyc	mogwuz	zitgov
	C	kovjel	wegrov	vakdro	pibkej	lukvix
16	A	gitsum	swegnt	gesiko	smajix	sobgiz
	B	brafen	jeharc	jademf	kenpro	angrum
	C	kovjel	ivjomn	berkuv	ogvidl	kremox
17	A	brafen	bnehuq	vyrnes	prabik	bofnmk
	B	kovjel	crekiv	lykvud	kijcez	kivoga
	C	gitsum	huvqim	stomdx	birsym	drugiq
18	A	kovjel	kaloms	hakvij	uvojac	ivjaks
	B	brafen	drynax	basewx	werhax	fabhok
	C	gitsum	wiquvs	tagihq	sukirp	sigbor
19	A	brafen	vaqerx	fparyx	bedavc	perbic
	B	gitsum	punsij	hugmep	tumhyq	kumjin
	C	kovjel	hopeiv	wavojm	lejpyk	kobjax
20	A	gitsum	nimkux	smyhud	mospyt	symgos
	B	kovjel	drojex	jubkal	bozerv	ukavij
	C	brafen	haresk	vahenp	nahquf	majesq
21	A	kovjel	sekmoy	jepviz	hexgov	vulpmj
	B	brafen	defbip	qebvor	nevbuq	nurbys
	C	gitsum	stuzac	desgom	magsok	mivunj
22	A	kovjel	vgohdl	cemvuj	sivjak	scorej
	B	brafen	ryxbof	gawbeq	jiburn	gybrek
	C	gitsum	wiksag	wemzus	wubisc	zibunt
23	A	brafen	gnurpa	wekans	nifbuz	vycban
	B	gitsum	gysemq	mysgep	buxtag	qimdag
	C	kovjel	qivkyc	bojnav	vylkuz	hijesk
24	A	gitsum	smacgo	surmyn	humgec	tycmrg
	B	brafen	fsibec	zebmaw	zenbug	cronyb
	C	kovjel	lkezdr	juvmoy	qoskij	hejiks

All letters were typed in lower case type on a primary size typewriter (Trade name: The Sight Saver -- 16 point type, 6 letter pitch). The items -- cue word and 4 alternates -- were typed on 5" x 8" white unlined cards, one item per card. The line of words was centered horizontally on the card; the cue word was $\frac{1}{4}$" from the left margin, the first alternate was $\frac{1}{2}$" from the cue word, and the 4 alternates were spaced equidistantly apart. The several sets of 72 typed item cards were reproduced by the multilith process.

Construction

Each of the positive stimuli -- f, l, and t -- were imbedded in 24 six letter nonsense syllables. These were designated the positive words. In addition to the positive stimulus, each positive word contained 2 other letters from the cue word. Excluding the stimulus letters, the remaining 5 letters in the cue word could be arranged in the following 20 two-letter combinations.

k-o-v-j-e-		b-r-a-e-n-		g-i-s-u-m-
1-2-3-4-5		1-2-3-4-5		1-2-3-4-5
1-2	2-1	3-1	4-1	5-1
1-3	2-3	3-2	4-2	5-2
1-4	2-4	3-4	4-3	5-3
1-5	2-5	3-5	4-5	5-4

To obtain the required 24 combinations, the 20 combinations were written on cards and shuffled. Four cards were drawn and the combinations added to the list.

Each positive word was completed by adding three letters chosen from the remainder of the alphabet (excluding the positive stimuli); each consonant was used an approximately equal number of times while the vowels were used more often.

The location of the positive stimulus in the word occurred with equal frequency in the initial, medial, and final positions. The randomized list of stimulus words thus derived and the respective cue words are presented in the following list.

brafen

initial	medial	final
facung	nujfez	bavguf
farwiq	rifuvb	cerymf
frawyh	nosfrj	zemnif
fyronk	gdefax	bwinsf
fumbor	knofaq	revpyf
fabhoh	bofnmk	jademf
fparyx	defbip	nohquf
fsibec	nifbuz	ryxbof

kovjel

initial	medial	final
lkezdr	holezg	brokly
lejpyk	qerlox	vgohdl
lykvud	coxljn	jubkal
lukvix	vlecax	ogvidl
lepkih	vloniq	secvyl
licjow	kaloms	jivaxl
lykbaj	vulpmj	jbewml
lanjuk	vylkuz	vnewrl

gitsum

initial	medial	final
tramuj	gatemp	bivsrt
tucjin	ghetuk	pmukat
tvuseq	ditmox	wigdyt
tsicnj	gbytuh	kwimvt
twegsd	zitgov	jukipt
tycmrq	stomdx	swegnt
tumhyq	stuzac	mospyt
tagihq	buxtag	zibunt

Corresponding to each cue word and in addition to, the 24 positive words, 72 additional words were constructed. These were designated the negative words. The negative words included 3 letters from the cue words (excluding the positive stimuli). Listed below are the 60 possible combinations of three letters that could occur.

k-o-v-j-e
1-2-3-4-5

b-r-a-e-n
1-2-3-4-5

g-i-s-u-m
1-2-3-4-5

123
124
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543

The 12 additional combinations needed to construct the 72 words were obtained by writing the above 60 combinations on cards, shuffling them, drawing 12 cards, and adding the combinations to the list.

Added to the three letters from the cue word were three letters selected from the remainder of the alphabet (excluding the positive stimuli); again, each consonant was used an approximately equal number of times while the vowels were used more often. The syllables containing the several combinations of stimuli were arranged in random order. The respective groups of negative words are contained in the following lists.

brafen

0 cnubex
1 grezaw
2 anbivs
3 rinham
4 brahom
5 berpos
6 kydnar
7 subenq
8 radcem
9 bgersk
10 binjax
11 qedanv
12 nirhek
13 degnaj
14 abrodz
15 drynax
16 bazewx
17 werhax

18 vaqerx
19 bedavc
20 perbic
21 zebnaw
22 zenbug
23 cronyb
24 rehboq
25 nadrum
26 nehawn
27 pobnrs
27 canpex
29 barpoz
30 rybnov
31 myrbez
32 gerdny
33 junbav
34 vibarq
35 nibroc

36 wobrin
37 kebnys
38 coranz
39 bnehuq
40 vyrnes
41 prabik
42 qebvor
43 nevbuq
44 murbys
45 gmurpa
46 wekans
47 vycban
48 buadex
49 jaxemb
50 wahenj
51 nerizq
52 pabnuz
53 adrybz

54 krejmx
55 juramx
56 arnjip
57 nyrisb
58 wendaq
59 girbaw
60 sekamb
61 nabcop
62 macdep
63 jeharc
64 kenpro
65 angrum
66 haresk
67 vahemp
68 najesq
69 gaubeq
70 jiburn
71 gybrek

kovjel

0 juvmoy
1 qoskij
2 hejiks
3 hopeiv
4 wavojm
5 kobjax
6 crekiv
7 kijcez
8 kivoga
9 wegrov
10 vakdro
11 pibkej
12 jiscoe
13 jeqomn
14 pexojs
15 erjavp
16 zevhik
17 nrkveg

18 gerzjo
19 kedohm
20 vegkuh
21 dijzoe
22 qhoven
23 pijwok
24 wajkyv
25 jrskod
26 jodvaz
27 romkes
28 vujemb
29 vonkim
30 dakomv
31 ojriks
32 rhevob
33 sijkeh
34 vpehox
35 qexork

36 osgvaj
37 wavjyk
38 vabdej
39 hakvij
40 uvojac
41 ijvaks
42 sekmoy
43 jepviz
44 hexgov
45 qivkyc
46 bojnav
47 hijesk
48 nakjoq
49 wekajy
50 vaxkeh
51 camvuj
52 sivajk
53 scorej

54 drojex
55 bozerv
56 ukavij
57 ivjomn
58 berkuv
59 kre[illegible]
60 yohesk
61 krowez
62 povjyd
63 yiksoj
64 zovhuc
65 woknuv
66 qijkuv
67 krevuc
68 novzoe
69 gijver
70 wogkec
71 gukjav

gitsum

0 dixpug
1 myrsud
2 sybgem
3 gymcun
4 grubix
5 sibmoz
6 mugdyx
7 qigmow

18 punsij
19 hugmep
20 kumjin
21 wiquvs
22 sukirp
23 sigbor
24 gnihsy
25 gavsuj

36 mihsez
37 qusmyc
38 mogwuz
39 hubqim
40 birsym
41 drugiq
42 desgom
43 magsok

54 gidurn
55 vumysq
56 qimjas
57 qigmaj
58 kumwij
59 zibmeg
60 sikgav
61 supweg

8 sugmax
9 qomsib
10 pogimb
11 cagvis
12 bamgir
13 secguk
14 kymgix
15 smacgo
16 surmyn
17 humgec
26 mujinx
27 husorg
28 zigsec
29 gehmuj
30 dixguv
31 midzuv
32 hicumz
33 wazgus
34 jupdig
35 esinux
44 mivunj
45 gysemq
46 mysgep
47 qimdag
48 dygmrs
49 waspum
50 gmidav
51 hispun
52 migcax
53 huvgos
62 cogump
63 gesiko
64 smajix
65 sobgiz
66 nimkux
67 smyhud
68 symgos
69 wiksag
70 wemzus
71 wubsic

A trial consisted of 3 items -- one corresponding to each stimulus sound. In order to prevent any systematic sequences from occurring, over the 24 trials of the task, an irregular order was employed in the vertical arrangement of the cue words and in the horizontal arrangement of the positive words.

Procedure and Directions
Discrimination Learning Verbal Task

brafen -- f; kovjel -- l; gitsum -- t.

This task involves discrimination learning. The subject must learn to respond differentially to similar stimuli; that is, he must respond positively to the f, l, and t sounds and fail to respond to the other sounds contained in the cue words. Be sure that the subject understands this process while and after working the example. If at any point during the task the subject appears confused about what is expected of him, reiterate the explanation.

Scoring is performed as follows. Timing. Begin the stop watch. when the first word on the card is read. Stop the watch when the correct response has been made. The attainment time is the cumulative time (rounded to the nearest second) for the three items of the trial. Reported time is the attainment time /100. Number of responses. Designate an incorrect response with a check and a correct response with an X. Record the total number of responses made on the three items.

The procedure and directions to be utilized with the subject appear below.

Here is a letter test. These cards are an example. We will work it together so you will know how to do this one (indicate main task).

See this word that has a line under it. It is not a real word. None of these words that you see are real words. They are just letters put together to look like words. Look at the letters in this word (indicate fespon). What are the letters in fespon (have subject enumerate the letters)?, That's right.

Now look at these four words (indicate line of words following fespon). They all have some of the letters that are in fespon. What are the letters that are the same in this word (indicate first word) and fespon? (Have subject enumerate the three letters that are the same; if he doesn't, point out the three letters that are the same. Repeat for 2nd, 3rd, and 4th words in the line.)

In this test you are going to find a letter I am thinking of. I will be thinking of a letter in this word (indicate and say fespon), so you know I am thinking of either the f, e, s, p, o, or n.

The letter I am thinking of is also over among these words (indicate 4 nonsense syllables to right of fespon). Choose one of these words, just by guessing. If it has the letter I am thinking of I will say yes, that word has the letter I am thinking of; if it doesn't have the letter I am thinking of, I will say no, guess again. Then you guess until you find the one which has the letter I am thinking of.

Begin Example

(Read first line of words. Subject makes choice. If incorrect one is chosen, have subject enumerate the letters which are the same as some of the letters.) You have found out something. Which letters are the same in fespon and this word? I will never be thinking of any of those letters when you see fespon. (Continue in this manner until the correct choice is made. When the correct choice is made) Yes, that word has the letter I am thinking of. (Have the subject enumerate the letters in fespon.) Now you know that it is one of those letters that I am thinking of. But, remember, in some of your other guesses you found out what letters it couldn't be.

Now look at the next line. Remember, I will be thinking of the same letter each time. I'll read this line to you. (Read second line of words). Now which word has the letter I am thinking of? (Investigator responds yes or no. If the subject responds correctly) Which letters are the same? Remember which letters were the same last time. Next time try to remember those letters and choose a word that has those letters. That will help you get it right.

(Follow the same procedure for trials 3 and 4. After trial 3 -- ask) Which letter do you think it is? Correct -- yes, each time you see the word that has that letter, choose that word the first time. (If the incorrect letter is chosen, put out first three cards. Show how 'p' was the letter that was the same on all three cards.) You have to find the letter which is the same for all the words.

Now we will go on to the main test. We will make it a little harder. This time we have three words: brafen (show the word), gitsum (show the word), and kovjel (show the word). I will be thinking of one letter for brafen, one letter for gitsum, and one letter for kovjel. I will be thinking of the same letter for each word each time you see the word. (Embellish) Each time you see brafen, I will be thinking of the same letter. (Repeat for gitsum and kovjel). Remember you have to find three letters. You will not tell me the letters though. I will know you are thinking of the right letter when you choose the right word each time.

Speed Set

Now you know what to do. You are to try to get them all right and, one other thing, try to get them all right as quickly as you can. Sometimes your teacher may ask you to work as fast as you can or to do as many as you can. Then you try to get all of the problems right as fast as you can; that way you make a better score. Well, that's what you are supposed to do with this test. The faster you do them right, the better score you make.

Begin Trial One

(Read the line of nonsense syllables. Have the subject respond. If the response is the incorrect one) no or no, that word does not have the letter I am thinking of; choose again. (When the correct response has been made) yes, that word has the letter I am thinking of. Now look at the first word, (indicate cue word) and this word (the correct response). Which letters are the same? Do not tell me. Just try to remember them. (Repeat this same procedure for the other two items in the trial).

(At the end of trial one say) That trial took you ___ seconds. (reported time -- actual attainment time plus 100). Your score was ___ seconds. You got them all right in ___ seconds.

Begin Trial 2

Here is the next trial. Remember, you are supposed to try to get all of the problems right as fast as you can. The less time you take, the faster you are, and the faster you do the problems, the better score you get. I'll know you know the letter when you tell the right word on your first choice.

On trials 2 through 8 continue this same procedure of administration; also, give speed and accuracy sets and reported times.

Reinforcement Schedule

C6 (D1 and D2) Continue above directions through the 24 trials.
C1 - C5 (D1 and D2) Give LA directions at the end of Trial 8.
C5 (D1 and D2) Continue speed and accuracy set, LA directions and reported scores through the 24 trials.
C1 - C4 (D1 and D2) Continue speed and accuracy sets, LA directions and administer respective false success and failure reports.

APPENDIX D

THE DISCRIMINATION LEARNING NON-VERBAL TASK: MATERIALS, CONSTRUCTION, PROCEDURE, AND DIRECTIONS

Materials

The task items as they were arranged for presentation to the subjects are grouped below according to trials. The total task included an example and 18 trials. The task booklet consisted of 19 pages; each trial and the example appeared on a separate page.

Example:

	2		9		6	
157	328	815	134	473	197	308

Trial 1:

	2		9		6	
503	155	684	433	490	302	357
718	307	170	210	747	500	110
435	838	568	109	331	431	117
841	953	340	328	585	516	388
747	114	705	514	604	740	801
597	782	184	385	708	834	860
779	570	442	334	175	235	505
136	723	771	953	553	709	350
443	885	717	507	482	394	380
140	317	632	718	457	815	884

Trial 2:

	2		9		6	
735	458	518	175	734	453	521
836	948	552	184	850	492	713
633	711	715	343	840	337	287
740	470	135	705	171	759	165
834	413	783	581	524	316	387
835	971	480	858	304	770	891
310	787	654	578	732	141	540
832	509	717	167	274	447	454
375	387	850	575	951	823	443
473	814	453	307	184	476	808

Trial 3:

	2		9		6	
344	537	389	375	847	840	867
181	140	245	538	817	843	324
535	755	407	937	876	707	805
537	194	350	102	147	141	705
873	615	749	341	453	557	280
305	181	467	132	751	931	304
313	506	745	503	877	478	808
323	473	682	710	873	891	454
715	412	185	371	510	458	137
360	354	158	889	715	254	833

Trial 4:

	2		9		6	
427	713	375	981	416	540	770
812	145	384	379	547	341	360
105	531	170	277	813	483	440
714	753	787	758	932	856	423
134	311	530	398	310	153	573
650	435	845	373	742	545	278
314	537	567	708	519	170	811
183	345	834	489	740	715	376
571	984	425	584	750	878	745
783	412	651	183	371	393	578

Trial 5:

	2		9		6	
408	215	547	344	530	145	753
579	855	867	350	833	806	350
940	103	515	488	715	524	790
378	674	784	414	811	780	174
152	588	464	471	349	314	131
235	705	747	757	813	136	137
128	734	475	951	540	545	535
833	502	373	614	471	118	552
388	740	393	783	748	578	710
481	233	383	381	418	865	439

Trial 6:

	2		9		6	
790	470	731	480	653	538	518
174	882	177	867	830	139	373
873	234	743	143	480	135	758
801	135	308	948	576	474	357
558	320	547	432	741	397	484
185	635	380	814	580	145	303
408	810	210	318	718	709	530
865	250	578	817	144	504	953
456	754	344	521	645	354	851
330	375	542	755	478	493	150

Trial 7:

	2		9		6	
440	905	585	127	583	376	158
745	474	344	845	374	537	488
654	893	802	530	148	704	460
804	273	151	340	744	719	535
854	455	324	150	810	438	988
547	715	110	307	416	850	595
531	732	138	857	650	751	747
314	108	140	849	384	367	748
274	838	548	475	383	727	914
535	110	386	818	185	454	751

Trial 8:

	2		9		6	
154	307	410	860	257	713	539
300	810	301	316	128	838	340
305	930	781	514	189	742	274
418	530	648	507	351	811	591
104	378	543	805	710	804	448
217	414	863	439	513	346	781
170	988	427	430	370	748	705
872	138	517	737	310	830	504
618	454	393	453	567	130	875
489	571	380	203	705	710	149

Trial 9:

	2		9		6	
853	671	135	485	896	812	358
340	508	727	848	501	145	743
230	850	361	313	780	199	814
901	507	336	810	355	824	753
435	307	841	613	402	840	718
375	538	451	598	171	275	438
743	374	530	550	154	851	168
839	940	717	525	584	180	308
485	145	376	858	378	531	844
473	673	137	302	791	715	550

Trial 10:

	2		9		6	
768	371	203	751	740	730	108
834	519	705	713	988	408	143
571	300	310	850	823	846	538
643	389	482	713	171	873	484
550	394	715	840	560	813	308
139	831	455	248	457	148	544
150	414	387	151	721	356	951
574	718	574	310	712	854	871
597	507	840	637	163	788	440
387	835	245	809	305	105	300

Trial 11:

	2		9		6	
743	795	586	230	110	310	401
650	511	875	470	352	571	154
598	353	803	654	440	758	749
130	314	838	154	740	244	173
361	519	614	332	837	308	480
501	188	418	891	711	503	149
458	800	705	710	180	237	341
160	835	400	718	351	324	473
574	180	546	908	780	344	193
450	144	641	812	507	570	853

Trial 12:

	2		9		6	
409	867	800	188	710	537	380
738	407	274	141	938	848	504
345	738	180	723	346	815	808
482	784	892	308	811	615	574
398	175	519	710	348	761	875
233	785	158	530	450	730	587
530	357	524	984	438	105	186
800	370	700	191	772	134	645
475	847	538	371	538	567	188
448	384	470	577	211	783	159

Trial 13:

	2		9		6	
850	547	374	413	782	593	143
804	604	530	549	161	135	280
474	585	711	350	504	375	481
975	801	483	540	306	571	458
785	721	531	507	731	895	347
407	875	142	643	503	338	300
544	589	734	213	360	413	170
180	141	810	470	805	307	740
428	935	754	856	850	714	172
173	587	593	814	178	619	430

Trial 14:

	2		9		6	
305	448	783	168	835	145	270
543	119	405	536	345	401	715
574	955	458	833	147	827	458
803	581	490	770	305	173	312
810	637	784	147	140	214	489
365	457	537	380	830	310	475
758	140	736	538	125	385	985
101	408	588	838	373	893	452
384	645	480	510	745	478	184
877	761	370	507	549	234	435

Trial 15:

	2		9		6	
607	785	398	738	348	702	857
470	830	101	150	845	370	765
104	438	819	708	234	588	427
580	301	471	746	958	480	147
800	718	504	457	135	745	182
840	315	590	370	671	157	242
168	538	841	348	305	708	480
439	738	576	470	815	457	435
980	580	183	824	140	798	485
715	152	578	408	810	343	618

Trial 16:

	2		9		6	
318	307	581	890	980	403	754
327	135	176	845	530	733	404
352	153	347	194	401	647	515
207	114	450	813	480	745	464
380	549	121	758	477	185	106
912	730	486	854	344	654	837
590	780	185	340	834	514	832
413	189	487	563	147	505	583
845	307	281	748	930	136	830
103	375	327	403	780	518	711

Trial 17:

	2		9		6	
178	843	300	419	702	564	541
350	230	418	727	745	834	148
356	588	515	374	984	507	371
138	102	617	493	538	884	757
483	810	413	837	275	150	578
134	368	838	711	589	484	141
878	800	508	856	971	311	574
125	442	894	181	110	807	748
650	407	354	573	308	830	139
585	357	765	245	475	440	177

Trial 18:

	2		9		6	
332	407	481	814	537	751	618
187	378	597	703	171	764	538
130	231	858	431	341	709	116
733	140	157	478	328	315	914
573	837	470	683	895	457	737
355	412	858	185	153	234	405
174	463	471	814	738	349	757
103	343	180	527	811	736	840
745	127	347	140	738	352	711
590	150	310	675	581	488	540

Construction

Adapted for the purpose of this task were the several randomized ten digit number series developed by Woodworth and Wells (1). In constructing the task seven lines of 30 digits were listed. Each line was conposed of three 10-digit series. The 30 digits were divided into 10 three-digit numbers. The numbers in which the 2, the 9, or the 6 appeared were designated as possible positive response alternates. Alterations were made so that only one positive stimulus occurred in any 10 digits. An irregular order was used to determine the sequence in which these positive stimuli occurred. In addition, the three digits in the remaining possible positive response alternates were rearranged so that each of the positive stimuli appeared with equal frequency in the initial, medial, and final positions.

For final presentation in the task format, the 70 three-digit numbers were arranged in ten rows with seven numbers in each row.

Procedure and Directions

Discrimination Learning Non-Verbal Task

This task involves discrimination learning. As such, the introductory comments to the Discrimination Learning Verbal Task apply here as well.

There are no number correct scores. Check the subject's responses and point out all errors. In general, there will be few non-chance errors.

To obtain the time scores, start the watch when the subject begins a trial and stop the watch when he indicates that he is finished. The total time rounded to the nearest second required to complete a trial is the attainment time. Reported time is the attainment time plus 100. The procedure and directions appear below.

This is a test using numbers. This first page is an example. See the numbers above the line - - the 2, the 9, and the 6. Then see the groups of numbers below the line. Either the 2, the 9, or the 6 may be hidden in some of these groups of numbers. Your job is to cross out each group of numbers that has either a 2, or a 9, or a 6 in it. Let's look at the first one. It's 1 - 5 - 7. Is one of the three numbers hidden in this group? No. Well, look at the second number group, 3 - 2 - 8. Do you see one of the hidden numbers? Yes - the 2 is hidden there. So you cross out that number group. (Continue through the line. Check to see that the subject is correct and be sure he understands the task.)

Now, let's look at the next page. This page is like the last one except there are more groups of numbers. Your job is to cross out every number group that does have a hidden number in it. Look up at the top as often as you need to see what the hidden numbers are that you are looking for.

Speed Set

Now you know what to do. You will try to get them all right as fast as you can.

One more thing, sometimes your teacher may ask you to work as fast as you can. That way you make a better score. Well, that's what you are supposed to do with this test. The faster you do these and do them right, the better score you make.

Begin Trial One

Now let's begin the first trial. Cross out every number group that has a 2, a 9, or a 6 in it. You can look at the example at the top of the page as often as you need to. Remember to work as fast as you can and be sure to get them all right. (At the end of Trial One, say) That trial took you ___ seconds. (Reported time - - attainment time plus 100). Your score was ___ seconds. You got them all right in ___ seconds.

Begin Trial Two

Here is the next trial. Remember you are to cross out the number group in which either the 2, the 9, or the 6 is hidden. Look up at the top of the page as often as you need to. Remember you are supposed to try to get all of the problems right as fast as you can. The less time you take, the faster you are, the faster you do the problems, the better score you get. At the end of Trial Two, repeat the procedure for reporting performance.

Reinforcement Schedule

C6 (D1 and D2) Continue above directions and procedure through the 18 trials.
C1 - C5 (D1 and D2) Administer the LA directions at the end of Trial Two.
C5 (D1 and D2) Continue speed and accuracy set, LA directions, and reported scores through the 18 trials.
C1 - C4 (D1 and D2) Continue speed and accuracy set and LA directions and administer respective false success and failure reports.

References

1. Woodworth, R.S. and Wells, F.L.
   Association Tests
   Psychol. Monogr., 1911, NO. 57

APPENDIX E

THE ROTE LEARNING VERBAL TASK: MATERIALS, CONSTRUCTION, PROCEDURE, AND DIRECTIONS.

Materials

The items included in the example and the 24 trials of the Rote Learning Verbal Task are listed below in the order in which they were administered to the subjects. During the task administration 24 cards were utilized; each card contained the 5 items of a trial.

Example:	item	stimuli	responses
demonstration	a.	dav	ceb
	b.	gex	koz
	c.	yad	fij
	d.	cim	bem
	e.	xud	rux
A.	a.	cim	
	b.	xud	
	c.	dav	
	d.	yad	
	e.	gex	
B.	a.	xud	
	b.	yad	
	c.	cim	
	d.	gex	
	e.	dav	
C.	a.	yad	
	b.	dav	
	c.	gex	
	d.	xud	
	e.	cim	

Trial Number	item	stimuli	responses
demonstration	a.	maz	wib
	b.	zic	kuh
	c.	bef	yot
	d.	coj	paf
	e.	giq	jeh
1.	a.	bef	
	b.	giq	
	c.	maz	
	d.	zic	
	e.	coj	
2.	a.	zic	
	b.	coj	
	c.	giq	
	d.	maz	
	e.	bef	

Trial Number	item	stimuli	responses
3.	a.	gig	
	b.	maz	
	c.	coj	
	d.	bef	
	e.	zic	
4.	a.	coj	
	b.	bef	
	c.	zic	
	d.	gig	
	e.	maz	
5.	a.	gig	
	b.	coj	
	c.	bef	
	d.	zic	
	e.	maz	
6.	a.	coj	
	b.	zic	
	c.	maz	
	d.	bef	
	e.	gig	
7.	a.	bef	
	b.	maz	
	c.	gig	
	d.	coj	
	e.	zic	
8.	a.	maz	
	b.	coj	
	c.	zic	
	d.	gig	
	e.	bef	
9.	a.	zic	
	b.	gig	
	c.	bef	
	d.	maz	
	e.	coj	
10.	a.	gig	
	b.	bef	
	c.	maz	
	d.	coj	
	e.	zic	
11.	a.	bef	
	b.	gig	
	c.	maz	
	d.	zic	
	e.	coj	

Trial number	item	stimuli	responses
12.	a.	gig	
	b.	bef	
	c.	zic	
	d.	coj	
	e.	maz	
13.	a.	zic	
	b.	gig	
	c.	coj	
	d.	maz	
	e.	bef	
14.	a.	maz	
	b.	gig	
	c.	zic	
	d.	bef	
	e.	coj	
15.	a.	gig	
	b.	coj	
	c.	zic	
	d.	maz	
	e.	bef	
16.	a.	zic	
	b.	gig	
	c.	maz	
	d.	bef	
	e.	coj	
17.	a.	bef	
	b.	zic	
	c.	gig	
	d.	coj	
	e.	maz	
18.	a.	coj	
	b.	maz	
	c.	bef	
	d.	zic	
	e.	gig	
19.	a.	zic	
	b.	maz	
	c.	coj	
	d.	gig	
	e.	bef	

Trial number	item	stimuli	responses
20.	a.	bef	
	b.	giq	
	c.	coj	
	d.	zic	
	e.	maz	
21.	a.	giq	
	b.	zic	
	c.	bef	
	d.	maz	
	e.	coj	
22.	a.	maz	
	b.	coj	
	c.	zic	
	d.	bef	
	e.	giq	
23.	a.	maz	
	b.	zic	
	c.	bef	
	d.	coj	
	e.	giq	
24.	a.	bef	
	b.	coj	
	c.	maz	
	d.	zic	
	e.	giq	

All of the nonsense syllables were typed in lower case letters on a primary size typewriter. (Trade name: The Sight Saver - - 16 point type, 6 letter pitch.)

The set of 5 items in each trial was typed on a 5" by 8" white unlined card. The list of items was centered horizontally on the card; vertically each item in the list was spaced equidistantly apart. On the demonstration card, there were 4 spaces between the stimulus response pairs.

A multilith process was employed to reproduce the required number of sets of trial cards.

Construction

A total of 20 three-letter nonsense syllables were included in the example and Rote Learning Verbal Task *per se*. Each syllable was composed of consonants in the initial and final positions and a vowel in the medial position.

All of the syllables were selected from the composite list which Hilgard (1) presented as containing syllables of low association value or meaningfulness.

The set of rules advanced by Hilgard (1) for the construction of nonsense syllable lists was followed as closely as possible in the construction of the list of five paired associates utilized in the task proper. That is to say the following conditions were observed.

1) A consonant appeared as the first letter of a syllable only once within the list.
2) A consonant appeared as the third letter of a syllable only once with the list.
3) No consonant appeared more than once in any four consecutive syllables.
4) No two letters of a syllable in the list were the same as two letters of another syllable.
5) Alphabetic sequences of consonants did not exist from syllable to syllable and within syllables.
6) The syllables were chosen in reference to their degree of association value.

There was one exception to the rule that no vowel should occur more than once within any four consecutive syllables. In the list of stimuli it was necessary to use the vowel i twice; therefore, from trial to trial as the vertical position of the syllables was irregularized the two syllables containing the letter i occasionally appeared in closer proximity than that specified by the rule. In addition, the lists were not utilized as circular series; rather, the syllable positions were irregularized from trial to trial. However, with the exception noted, the rules were observed in all syllable orders employed.

As stated, the vertical position of the stimulus response pairs was varied in an irregular order from trial to trial. The purpose of this procedure was to insure that the subjects learned to associate the stimulus response pairs rather than to produce the response syllables as a serial list.

Procedure and Directions
Rote Learning Verbal Task

This task involves the learning of arbitrary rote associations. The subject must learn to associate the several stimulus response pairs of syllables. He demonstrates this acquisition by supplying in the specified time the response member for the stimulus member in whatever position it appears. He should understand the idea of this process during and after the example. If at any time during the task the subject appears confused about what is expected of him, reiterate the explanation.

Scoring will include time and the number of responses supplied per trial. Scoring is performed in the following manner. As the first stimulus syllable is pronounced, start the watch. Stop the watch when the subject supplies the correct response syllable or after ten seconds if the correct response syllable is not supplied. If the subject does not supply the correct response syllable within four responses, credit him with ten seconds and four responses. Repeat this procedure for the five stimulus-response pairs in each trial. The total response score for each trial equals the sum of the number of responses for each of the five pairs that constitute a trial.

The total attainment time for each trial equals the sum of the attainment time for each of the five items. Reported time equals the attainment time plus 150.

The procedure and directions appear below.

This morning/afternoon we are going to play "word partners". This task is made up of 24 cards. On each card you will see five funny little words. Every card will have the same five words but they will be in different positions on all the cards.

Here are 4 sample cards. These are not the same words or word partners we will use but you may get an idea how we play "word partners". (Show sample cards. Explain how the same words are on all the cards but in different positions.

Give the word partners for the 5 sample words.)

dav - ceb
gex - koz
yad - fij
cim - bem
xud - rux

(Explain if bem is the word partner for cim on card one, then bem must be the word partner for cim on the other three cards. Ask the child,) If koz is the word partner for gex on card one, what is the word partner for gex on card two; card three; card four?

Each word on a card has a word partner. In the test, I'll tell you what the word partners are before we start. The words on the cards will always have the same word partners no matter in what position you see the word.

When we start you will see only one card at a time. I'll say the words for you one at a time and you try and remember the word partner for that word. You may guess as many times as you wish.

If you cannot remember the word partner, I'll tell you the correct word partner for that word. Then we will go on to the next word on the card.

We will play until we finish all 24 cards. You are to try and see if you can bring the words and correct word partners together.

Remember, no matter in what positions the words are the word partners always remain the same. Any questions? (If so, clarify the process further; if not, begin the test.)

Speed Set

Now you know what to do. One other thing, try to get them all right as quickly as you can. Sometimes your teacher may ask you to work as fast as you can, or to do as many problems as you can. That way you make a better score. Well, that's what you are supposed to do with this test. The faster you do them right, the better score you make. Now, let's begin the first trial.

Begin trial one

(Read the demonstration card containing the stimulus response members to the subject. Then expose to the subject the card containing only the stimulus members, read one item at a time. If the subject supplies an incorrect response, comment to this effect. Say no, wrong, that is not ___'s word partner, etc. If the subject does not supply the correct response within 10 seconds or within four items, supply it and proceed to the next item. Continue for the five items.)

(At the end of trial one, say)

That trial took you ___ seconds (Reported time - - actual attainment time plus 150.) Your score was ___ seconds. You got them all right in ___ seconds.

Begin trial two

Here is the next trial. Remember, you are supposed to get all of the problems right as fast as you can. The less time you take, the faster you are, and the faster you can do the problems, the better score you get.

(Continue through trial eight with the same procedure of administration of item cards - - do not expose demonstration card again - - giving speed and accuracy set at the beginning of each trial and reported time at the end of each trial.)

Reinforcement Schedule

C6 (D1 and D2) Continue above directions through the 24 trials.

C1 - C5 (D1 and D2) Administer LA directions at the end of trial 8.

C5 (D1 and D2) Continue speed and accuracy set, LA directions, and reported scores through the 24 trials.

C1 - C4 (D1 and D2) Continue speed and accuracy directions, LA directions and administer respective false success and failure reports.

References

1. Hilgard, E.R. Methods and procedures in the study of learning. In S.S. Stevens (Ed.), Handbook of Experimental Psychology. New York: John Wiley, 1951, Pg. 517--567.

APPENDIX F

THE ROTE LEARNING NON-VERBAL TASK: MATERIALS, CONSTRUCTION, PROCEDURE, AND DIRECTIONS.

Materials

Listed below are the items of the Rote Learning Non-Verbal Task as they were organized for administration to the subject. The task included an example and 18 trials. When the task was administered to the subjects, each trial was contained on a separate page and the 19 pages were stapled together to form a task booklet.

Example:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

G F B A C I H F D

Trial 1:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

H I D H B I H D G

D B G B H F D G H

A D F G C D C B I

G I E A C B F A H

Trial 2:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

D I A H F G H B C

H A D E B E C G F

E D B A D I F H C

I B I C A G E G H

Trial 3:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

B D C F I G E D B

I E B D F H A D F

B D A E A G C D H

C H B I G F E H B

Trial 4:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

H E H B F A B G F

A D I F A I H C D

E H C I C E G E F

D A C A C D F G F

Trial 5:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

E	I	G	A	B	G	C	D	A

E	B	G	D	G	C	I	A	E

C	D	G	B	D	E	H	A	F

B	A	C	B	I	B	F	A	G

Trial 6:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

B	G	F	B	A	F	E	C	G

I	B	C	B	F	E	D	C	E

D	E	C	B	F	I	B	A	D

A	B	C	H	C	E	A	D	C

Trial 7:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

A	E	C	H	I	A	B	H	E

B H B A G C F H D

G H D C D E G H D

D F I E B C G A F

Trial 8:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

B C D A F H C H F

H I A D B C I D E

F G E A I D C A H

H F A G H C A F B

Trial 9:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

B F D G A F G C I

I C D B G F E B H

G A H D F H D G F

B H I E D I B C H

Trial 10:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

G	H	A	B	I	A	F	D	B

E	A	B	H	E	I	A	D	H

F	D	I	A	I	E	B	C	G

I	A	C	F	D	I	H	G	D

Trial 11:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

E	A	H	G	I	H	B	C	D

D	E	F	D	G	A	I	D	B

F	E	I	E	H	C	B	I	F

F	E	H	I	B	F	I	A	C

Trial 12:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

B	D	H	G	I	E	I	C	H

A	B	E	H	F	C	F	G	F

D I D G B H C F D

B A C A F E I B D

Trial 13:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

D H I A C G D F C

G A B G H E G F I

F D A C H B H I B

C F D F E A B G H

Trial 14:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

D I C E D C H E B

E C D A E A I C E

I G D I H B C H E

C G I F A I E F D

Trial 15:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

F A C E B I D B A

H D F A B G D H E

C I A H E H F G I

F H A E A B G B E

Trial 16:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

G F A F A I B G B

C H A F H A G C G

A I B F A E D F C

G A H G F G I G C

Trial 17:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

G B E I B C B D C

I B F D A B G F E

G C D E G D E C G

I G F D E H D B I

Trial 18:

A	B	C	D	E	F	G	H	I
2	9	4	1	7	5	3	8	6

H D C A F E A B A

I C D G D F E I C

I B E A I D H F H

E D I F C A I F C

All of the letters and numbers were typed in lower case letters on a primary size typewriter (Trade name: The Sight Saver - - 16 point type, 6 letter pitch).

Each trial, consisting of 36 items, was typed on separate sheets of 8½" by 11" white unlined bond paper. The five horizontal rows -- demonstration and 4 rows of 9 task items each - - were centered horizontally and spaced equidistantly vertically on the page. There were two spaces between item. A spirit duplicating process was utilized in reproducing the necessary number of sets of the complete task.

Construction

The task consisted of 9 paired associates. The stimulus members of the pairs were the first nine letters of the alphabet, the response members, the digits 1 through 9. The letters and digits were paired on a random basis. As a result, there was no systematic sequence between the two series of material that were arbitrarily paired.

Held constant from trial to trial was the format of the demonstration illustrating the paired associates. On the other hand, the stimulus material in the task items *per se* was varied on a random basis. The purpose of this randomization was to insure that within a trial or between trials no consistent sequence of stimuli occurred.

Procedure and Directions
Rote Learning Non Verbal Task

This task involves the rote learning of nine arbitrarily paired stimulus response combinations. The comments about the process involved in the Rote Learning Verbal Task apply also to this task.

Scoring is identical to that utilized on the other non verbal tasks. There are no number correct scores. For time scores, start the watch when the subject begins the initial item, stop the watch when he completes the final item. Attainment time is the total time (rounded to the nearest second) required to complete a trial. Reported time is attainment time plus 100. The procedure and directions appear below.

Here is a test using letters and numbers. On this first page is an example. See these letters in these boxes across the top. And then - - see the numbers in the boxes across the bottom. Each of these letter - - number pairs go together. Each number stands for a letter. In other words, A goes with 2, B goes with 9, (Continue through the list.).

Now look at this second row. Here you see that the boxes at the top have the letters in them - - but the numbers are missing from the boxes at the bottom. Also, the letters are in mixed up order. Your job is to write in the missing numbers. You are to write in the number that goes with each letter. Now - - look at the first letter here. It's G. What number goes with it. That's right - - the number that goes with it is 3. All right - - you write a 3 in the box under the G. All right, look at the second letter. What is it? That's right. It's F. Now what number goes with F? That's right. 5 goes with F. Now you know what to do. Fill in the rest of the boxes. You may look at the example across the top as often as you need to find out what numbers and letters go together. (Check to see that the subject fills in the correct responses.)

Now, turn the page. See this page is like the last one except that there are more lines of boxes with the numbers missing. And in every line the letters are in mixed up order. However, this box across the top tells you what letters go with what numbers. The letter-number pairs always remain the same. You are to fill in all of the empty boxes at the bottom and you can look at the example at the top as often as you need to.

Speed Set

Now you know what to do. You are to try to get them all right, and, one other thing, try to get them all right as quickly as you can. Sometimes your teacher may ask you to work as fast as you can; that way you make a better score. Well, that's what you are supposed to do with this test. The faster you do these and do them right, the better score you make.

Begin Trial One

Now let's begin the first trial. Fill in the right numbers to go with each letter. You can look at the example at the top as often as you need to. Remember to work as fast as you can and be sure to get them all right. (At the end of Trial One, say) That trial took you ___ seconds. (Reported time - - attainment time plus 100.) Your score was ___ seconds. You got them all right in ___ seconds.

Begin Trial Two

Here is the next trial. Remember you are to fill in the numbers that go with the letters. Write the right numbers in the empty box under each letter. Remember you are supposed to try to get all of the problems right as fast as you can. The less time you take, the faster you are, and the faster you do the problems, the better score you get. (At the end of Trial Two, repeat the procedure for reporting performance.)

Reinforcement Schedule

C6 (D1 and D2) Continue above directions through the 18 trials.
C1 - C5 (D1 and D2) Administer LA directions at the end of Trial Two.
C5 (D1 and D2) Continue speed and accuracy set, LA directions, and reported scores through the 18 trials.
C1 - C4 (D1 and D2) Continue speed and accuracy set and LA directions and administer respective false success and failure reports.

APPENDIX G

THE CONCEPT FORMATION VERBAL TASK:
MATERIALS, CONSTRUCTION, PROCEDURE, AND DIRECTIONS.

Materials

The 72 items of the task are listed below in the order in which they were presented to the subject. During the administration of the task each combination of categorical name and response alternates which comprised an item was contained on a separate card.

Example:

Item	Category Name	Response Alternates			
A	zippo	board	market	Monday	bag
B	zippo	Thursday	red	gate	tin
C	zippo	flag	Tuesday	post	stripe
D	zippo	court	handle	tale	Friday
E	zippo	Wednesday	blue	prize	band
F	zippo	flame	bridge	Sunday	nap

Trial Number:	Item	Category Name	Response Alternates			
1	a	sebi	banana	church	six	radio
	b	mufa	face	carpenter	pine	chapter
	c	bafo	pheasant	page	drum	calf
2	a	mufa	part	oak	clown	hair
	b	bafo	sled	monkey	evening	sparrow
	c	sebi	twenty	telephone	pocket	garage
3	a	sebi	secret	tent	cup	eleven
	b	mufa	shoulder	girl	snow	yellow
	c	bafo	marbles	green	fox	owl
4	a	mufa	hay	finger	tire	hunter
	b	sebi	blanket	den	zero	fence
	c	bafo	buffalo	apple	duck	horn
5	a	bafo	stork	coat	mouse	puzzle
	b	mufa	wind	comb	conductor	skin
	c	sebi	third	mop	camp	work
6	a	sebi	fork	corner	thousand	house
	b	bafo	wagon	horse	gift	pigeon
	c	mufa	jaw	parade	river	messenger
7	a	mufa	thorn	noon	toe	baby
	b	sebi	curtain	twelve	egg	stable
	c	bafo	dollar	balloon	parrot	deer
8	a	bafo	squirrel	wren	tricycle	blue
	b	sebi	bottle	pipe	one	hotel
	c	mufa	acorn	leg	bean	nurse
9	a	sebi	ninth	nut	button	pillow
	b	mufa	playmate	morning	eye	lily
	c	bafo	dominoes	bear	today	turkey
10	a	mufa	tongue	leader	rain	drink
	b	bafo	shoe	scooter	rabbit	lark
	c	sebi	carrot	toaster	wigwam	two
11	a	sebi	dish	pole	forty	castle
	b	mufa	farmer	knee	peach	wood
	c	bafo	pound	doll	sea gull	dog

Trial Number	Item	Category Name	Response Alternates			
12	a	bafo	blocks	goal	wool	woodpecker
	b	mufa	baker	mud	head	airplane
	c	sebi	five	cabin	trap	glass
13	a	mufa	mouth	man	shell	breakfast
	b	bafo	chalk	skates	camel	robin
	c	sebi	bucket	candy	apartment	eight
14	a	bafo	lion	checkers	penny	pelican
	b	mufa	yard	surprise	doctor	tooth
	c	sebi	barn	three	grade	television
15	a	mufa	grocer	sign	arm	pasture
	b	sebi	dress	inn	plate	first
	c	bafo	rooster	chipmunk	gasoline	bicycle
16	a	bafo	elephant	hawk	football	west
	b	sebi	shed	seven	north	lamp
	c	mufa	fireman	coffee	ear	moon
17	a	bafo	swan	east	giraffe	top
	b	sebi	hundred	cave	hot	napkin
	c	mufa	beach	neighbor	ribbon	hand
18	a	mufa	singer	brown	neck	storm
	b	sebi	store	fifteen	milk	kettle
	c	bafo	dove	rattle	spade	tiger
19	a	mufa	root	chin	sound	boy
	b	bafo	pig	swallow	swing	pair
	c	sebi	sheet	night	building	four
20	a	sebi	clock	thirteen	tar	palace
	b	bafo	truck	kite	eagle	kangaroo
	c	mufa	lip	bloom	pack	king
21	a	mufa	friend	foot	orange	moss
	b	sebi	school	month	pan	nine
	c	bafo	zebra	crow	whistle	potato
22	a	bafo	parakeet	ship	elk	bat
	b	sebi	cottage	second	crown	spoon
	c	mufa	sail	rock	driver	throat
23	a	sebi	ten	trailer	sweater	mirror
	b	mufa	lady	nose	tree	collar
	c	bafo	seesaw	dinner	hen	cat
24	a	bafo	goose	wolf	paint	tea set
	b	mufa	white	seed	captain	elbow
	c	sebi	broom	hospital	fifty	cracker

All of the nonsense syllables and words were typed in lower case letters on a primary size typewriter (Trade name: The Sight Saver - - 16 point type, 6 letter pitch).

Each item was typed on a 5" x 8" white unlined card. The item was centered horizontally on the card; the category name was ½" from the left margin, the first response alternate was 3/4" from the category name, and the 4 alternates were placed equidistantly in the remaining space. A spirit duplicating process was employed to reproduce the required number of sets of item cards.

Construction

The object nouns were selected from the words contained in the Gates Primary Word List (1). A list was made of every common noun included in the Gates material. These were classified into the following categories: household, shelter, time, number, people, parts of people, animals, birds, nature (excluding animals and birds), toys, food, school, transportation, tools, quantity (excluding number per se), clothes, direction, color, miscellaneous (all nouns not applicable to the preceding categories).

After several series of pilot tests the number, animal, and parts of people categories were designated as those to contain the correct response alternate: Six additional categories were selected for parallel presentation with the above listed categories. In addition, all of the remaining categories were pooled to form one miscellaneous category. Thus there were three series of categories. The first series included the categories animals, birds, toys, and miscellaneous; the second series, the categories parts of people, people, nature, and miscellaneous; the third series, the categories number, household, shelter, and miscellaneous. The animal category was designated the bafo category and the parallel categories of nouns in the first series were used only as the response alternates in the bafo items. Similarly, the parts of people category became the mufa category and the parallel categories of the second series were employed as the response alternates in the mufa items; the number category was the sebi category and the parallel categories of third series were utilized as the response alternates in the sebi items.

Twenty four nouns were selected from each category in the three series. These were the nouns finally used in the task. In order to insure that no alphabetic or other sequence obtained, the 24 nouns in each category were written on cards and these cards were thoroughly shuffled. In addition, to prevent position bias the horizontal position of the categories in each item series and the vertical position of the three items were irregularized over the 24 trials. This was done so that (1) the correct alternates appeared with equal frequency in each horizontal position, (2) the several items appeared with equal frequency in each vertical position, and (3) the horizontal position of each correct response alternate was not identical in any two consecutive trials.

Procedure and Directions
Concept Formation Verbal Task

Zippo - - days of the week; bafo - - animals; mufa - - parts of people; sebi - - numbers.

This task involves concept formation. As such, the subject must ignore concrete, peripheral differences in object nouns and group on the basis of an intrinsic underlying class characteristic or categorical relationship. N.B. It is extremely important that the subject get this idea of process in the example. If at any time during the task he appears to be confused about what is expected of him, reiterate the explanation.

Scoring is like the Rote Learning Verbal Task. Start the watch with presentation of the first item; stop it when he makes the correct response; start it at the beginning of the next item; stop at the correct response to item, etc. Attainment time is the total time (rounded to nearest second) required for the three items Reported time is attainment time plus 100. Also record the total number of responses made on the three items.

The procedure and directions appear below.

In this test you will work with word relatives. Word relatives are words that belong together in the same way - they are members of the same family. (Discuss with the subject his personal relatives-- aunts, uncles, mother, father, brothers. Stress that all are different, all have different names - but all belong together in some way-- they are members of the same family; i.e. all are object nouns which can be grouped into one class on the basis of one categorical characteristic - - family).

Your job in this test is to find some group of word relatives that I tell you the family names for. Let's start with an example. Let's work it together so that you will know how to do the test when you come to it.

Look at this first card. See this word over here on the left hand side of the card - it has a line under it. It's zippo. You've probably never heard that word before - it's a made-up word. Look at the line of words on the right. They are board, market, Monday, bag. (Read the words aloud.) Now one of these words belongs to the zippo family. It goes with zippo. Now, you find out which one it is.

Begin by guessing, and I'll tell you whether you are right or wrong. (Say "right" after the weekday word, and "wrong" after the other three. When the subject guesses the correct word, proceed to the next card). That's right. The zippo word is Monday.

Now, let's look at the next card. Find the member of the zippo family. Remember the last time we saw zippo - the right word was Monday. Here's zippo again. What word is going to go with zippo this time? Remember, it has to belong to the same family. All right, let's find the zippo word. (Read the four object nouns to the subject.) Yes, that's right, Thursday. Monday and Thursday are both in the zippo family. Now let's look at the next card. What's the word that is in the zippo family with Monday and Thursday? (Continue the same procedure through the 5 cards.)

You found all of the members of the zippo family. Each zippo word was different from the other zippo words in many ways; but they were all alike in one way - - they were all days of the week. They belonged together in one way - - they were members of the same family - - days of the week.

So all of the members of the zippo family were different in many ways, but alike in being members of the same family. (Be sure that the subject can understand the idea of ignoring specific object characteristics to grasp the categorical characteristic which defines the class.)

Let's begin the test. In the test there are three families - - the bafo family, the mufa family, and the sebi family. You are to discover the members of each of these word families - - the word relatives that belong together in some way. Begin by guessing, and I'll tell you whether your guesses are right or wrong. Are you sure you understand what to do? (If so, begin the test; if not, further discuss the example.)

Speed Set

Now you know what to do. One other thing, try to get them all right as quickly as you can. Sometimes your teacher may ask you to work as fast as you can, or to do as many problems as you can in a certain time. Then you try to get all of the problems right as fast as you can. That way you can make a better score. Well, that's what you are supposed to do with this test. The faster you do them right, the better score you make. Now, let's begin the first trial.

Begin Trial One

(Read the class name and four object words. Have the subject guess. If guess is incorrect, comment to this effect. Say "no" or "wrong". That is not the bafo (or other) word. It doesn't belong in the bafo family, etc. If the guess is correct, make the opposite comments. Vary specific comments from trial to trial.)

(At the end of Trial One, say) That trial took you ___ seconds. (Reported time - - actual attainment time plus 100) Your score was ___ seconds. You got them all right in ___ seconds.

Begin Trial Two

Here is the next trial. Remember, you are supposed to get all of the problems right as fast as you can. The less time you take, the faster you are, and the faster you can do the problems, the better score you get.

(Continue through Trial Eight with the same procedure of administration, giving the speed and accuracy set at the beginning of each trial and reported time at the end of each trial.

Reinforcement Schedule

C6 (D1 and D2) Continue above directions through the 24 trials.
C1 - C5 (D1 and D2) Administer LA directions at the end of Trial Eight.
C5 (D1 and D2) Continue speed and accuracy set, continue LA directions, and reported scores through the 24 trials.
C1 - C4 (D1 and D2) Continue speed and accuracy sets and LA directions and administer respective false success and failure reports.

References

1. Gates, A.I. A Reading Vocabulary for the Primary Grades, Revised.
New York: Teachers College, Columbia University, 1935.

APPENDIX H

THE CONCEPT FORMATION NON-VERBAL TASK: MATERIALS, CONSTRUCTION, PROCEDURE, AND DIRECTIONS.

Materials

The items included in the example and the 18 trials of the Concept Formation Non-Verbal Task are presented below in the order in which they were administered to the subjects. During the actual task administration each trial was contained on a separate sheet and the 19 sheets were stapled together to form a task booklet.

Example:

+a	= -a-	) 6	✓ --6-

___ a
___ -6-
___ -a-
___ 6
___ --d-
___ 4
___ y
___ -8-

Trial 1:

+a	= -a-	) 6	✓ -6-
___ f	___ 2	___ p	___ -3--
___ 3	___ -5-	___ -w-	___ -x-
___ -s-	___ j	___ 4	___ 8
___ -9-	___ -y-	___ -6-	___ v
___ 5	___ -u-	___ -g-	___ -4-
___ -7-	___ -z-	___ -i-	___ -7-
___ a	___ b	___ 9	___ -k-

Trial 2:

+a	= -a-	) 6	✓ -6-
___ -4-	___ n	___ 8	___ -y-
___ -x-	___ -i-	___ -5-	___ -7-
___ 6	___ 3	___ t	___ p
___ b	___ -8-	___ -r-	___ 9
___ -a-	___ -f-	___ 7	___ k
___ z	___ g	___ m	___ 4
___ -e-	___ -9-	___ -6-	___ -y-

Trial 3:

+ a	= -a-	) 6	___ -6-
___ v	___ -5-	___ -n-	___ 7
___ -a-	___ -p-	___ -7-	___ -2-
___ 3	___ z	___ t	___ c
___ -9-	___ q	___ 5	___ -d-
___ -w-	___ -6-	___ j	___ 4
___ i	___ 9	___ 8	___ f
___ -3-	___ -y-	___ -g-	___ -8-

Trial 4:

+ a	= -a-	) 6	✓ -6-
___ 3	___ t	___ -3-	___ -s-
___ f	___ 5	___ 4	___ -8-
___ -5-	___ -r-	___ -h-	___ 2
___ -d-	___ -4-	___ -a--	___ -9-
___ -p-	___ 7	___ q	___ -b-
___ -2-	___ -6-	___ -e-	___ 6
___ z	___ m	___ 8	___ -k-

Trial 5:

+ a	= -a-	) 6	✓ -6-
___ -6-	___ j	___ r	___ -5-
___ -f-	___ a	___ -m-	___ 7
___ 8	___ -8-	___ 4	___ -q-
___ y	___ 2	___ -9-	___ c
___ 5	___ w	___ -v-	___ 3
___ -2-	___ 9	___ -7-	___ g
___ b	___ -d-	___ x	___ -4-

Trial 6:

+ a	= -a-	) 6	✓ -6-
___ 4	___ -f-	___ -u-	___ -8-
___ -g-	___ -4-	___ q	___ 3
___ y	___ h	___ -3-	___ -i-
___ -e-	___ 7	___ 9	___ a
___ 2	___ t	___ -6-	___ n
___ b	___ 8	___ -k-	___ -r-
___ -2-	___ -n-	___ 5	___ -5-

Trial 7:

+ a	= -a-	) 6	✓ -6-
___ -8-	___ -6-	___ 3	___ -4-
___ 2	___ -r-	___ x	___ h
___ -b-	___ p	___ 7	___ 6
___ c	___ -3-	___ a	___ q
___ f	___ 9	___ -2-	___ 4
___ -k-	___ -5-	___ -w-	___ -t-
___ 5	___ i	___ -d-	___ -7-

Trial 8:

+ a	= -a-	) 6	✓ -6-
___ -5-	___ -r-	___ -m-	___ -3-
___ -d-	___ -s-	___ -4-	___ a
___ 3	___ x	___ z	___ 6
___ b	___ -8-	___ -p-	___ -6-
___ 9	___ 7	___ 2	___ 8
___ -2-	___ h	___ -7-	___ -k-
___ r	___ 5	___ -y-	___ f

Trial 9:

+ a	= -a-	) 6	✓ -6-
___ b	___ -q-	___ 5	___ -g-
___ 2	___ -a-	___ -2-	___ 7
___ -e-	___ -8-	___ -n-	___ p
___ -4-	___ v	___ h	___ 8
___ 6	___ 9	___ -5-	___ r
___ -6-	___ x	___ 3	___ -9-
___ m	___ -y-	___ -3-	___ -t-

Trial 10:

+ a	= -a-	) 6	✓ -6-
___ -4-	___ -w-	___ -z-	___ t
___ 8	___ 4	___ c	___ 5
___ -j-	___ -9-	___ -s-	___ -s-
___ b	___ 3	___ -p-	___ -3-
___ h	___ -5-	___ -k-	___ 7
___ -r-	___ -d-	___ -6-	___ -8-
___ 6	___ 9	___ g	___ a

Trial 11:

+ a	= -a-	) 6	√ -6-
___ -w-	___ -6-	___ -4-	___ -a-
___ -8-	___ 8	___ -j-	___ 6
___ k	___ -2-	___ -5-	___ -7-
___ 7	___ a	___ 2	___ -b-
___ x	___ -p-	___ -d-	___ c
___ 3	___ 5	___ m	___ -9-
___ -a-	___ g	___ s	___ w

Trial 12:

+ a	= -a-	) 6	√ -6-
___ 8	___ -a-	___ c	___ 9
___ b	___ -5-	___ 7	___ -6-
___ -3-	___ r	___ -i-	___ t
___ -f-	___ 4	___ -4-	___ -y-
___ -9-	___ j	___ -w-	___ -8-
___ -d-	___ -h-	___ x	___ m
___ 6	___ 5	___ -7-	___ z

Trial 13:

+ a	= -a-	) 6	√ -6-
___ -i-	___ w	___ 8	___ -g-
___ c	___ -9-	___ -2-	___ m
___ -4-	___ 3	___ f	___ u
___ 6	___ r	___ 2	___ 7
___ -7-	___ s	___ -k-	___ p
___ -k-	___ h	___ -3-	___ -4-
___ 9	___ -a-	___ 5	___ -d-

Trial 14:

+ a	= -a-	) 6	√ -6-
___ 4	___ f	___ 2	___ r
___ z	___ -v-	___ -5-	___ -3-
___ -3-	___ -6-	___ t	___ 7
___ -h-	___ m	___ 5	___ 8
___ -8-	___ 9	___ -y-	___ -9-
___ 6	___ b	___ -2-	___ i
___ -a-	___ -w-	___ -u-	___ -n-

Trial 15:

___ + a	___ = -a-	___) 6	___ ✓ -6-
___ -d-	___ -4-	___ e	___ 3
___ c	___ 5	___ 8	___ -9-
___ -5-	___ -g-	___ -r-	___ s
___ 4	___ u	___ -3-	___ -h-
___ -a-	___ m	___ 6	___ -p-
___ -b-	___ -k-	___ -7-	___ n
___ 7	___ z	___ -f-	___ -8-

Trial 16:

___ + a	___ = -a-	___) 6	___ ✓ -6-
___ -6-	___ z	___ -7-	___ w
___ -a-	___ b	___ 6	___ -8-
___ 4	___ -r-	___ 5	___ -m-
___ t	___ 8	___ -3-	___ -g-
___ -9-	___ -2-	___ d	___ -5-
___ 2	___ -v-	___ -y-	___ k
___ -h-	___ p	___ 9	___ 3

Trial 17:

___ + a	___ = -a-	___) 6	___ ✓ -6-
___ 3	___ 6	___ d	___ -a-
___ y	___ n	___ -u-	___ 9
___ -4-	___ 5	___ -8-	___ -4-
___ -e-	___ -p-	___ 7	___ -x-
___ -j-	___ -2-	___ -h-	___ r
___ -3-	___ 2	___ a	___ -9-
___ g	___ -5-	___ f	___ 8

Trial 18:

___ + a	___ = -a-	___) 6	___ ✓ -6-
___ e	___ 8	___ -3-	___ -r-
___ -9-	___ -6-	___ 9	___ m
___ x	___ q	___ -k-	___ -7-
___ 3	___ -g-	___ c	___ 4
___ d	___ 6	___ f	___ -8-
___ 5	___ s	___ -i-	___ -n-
___ -v-	___ -a-	___ z	___ -5-

All of the letters and numbers were typed in lower case letters on a primary size typewriter (Trade name: The Sight Saver - - 16 point type, 6 letter pitch).

The 28 items of each trial were typed on separate sheets of 8½" by 11" white unlined bond paper. Four columns, each containing seven items, were spaced equidistantly on a page. Vertically, there were 2 spaces between each item.

A spirit duplicating process was utilized in reproducing the necessary number of sets of the complete task.

Construction

Four categories of stimuli were utilized. These included letters, struck through letters, numbers, and struck through numbers. These categories were represented by four symbols - - cross, parallel horizontal lines, half circle, and check, respectively. Each trial included seven representatives of each category.

The letters and the struck through letters were selected from 24 letters of the alphabet - - the l and the o were excluded. The numbers and struck through numbers were drawn from the numeric sequence from two to nine - - the zero and one were excluded. The purpose of the exclusions in both cases was to prevent confusion of the letters l and o with the typed numbers one and zero. In any one trial seven different letters were drawn from the 24 possibilities for each of the two categories; there was no overlap in letters in a trial. The specific letters used in each category were varied from trial to trial. In each trial the seven digit possibilities were used twice.

In order to preclude the occurrence of a systematic sequence, an irregular order was followed in the vertical arrangement of representatives of the four classes.

Procedure and Directions
Concept Formation Non-Verbal Task

This task involves concept formation; therefore, the comments about the process involved in the the Concept Formation Verbal Task apply here also.

Scoring is the same as that used on the Discrimination Learning Non-Verbal and Rote Learning Non-Verbal Tasks. There are no number correct scores. For time scores start the watch as the subject begins the first item; stop the watch when he completes the final item. Attainment time is the total time (rounded to the nearest second) required to complete a trial. Reported time is attainment time plus 100.

The procedure and directions appear below

Today we have a test in which you are to learn what figures go with a group of things. We have four groups - - a group of letters that stand along, a group of letters with lines drawn through them, a group of numbers that stand alone, and a group of numbers with lines through them. And we have four symbols or figures - a cross, two short lines, a half circle, and a check mark. (Point out as named).

Now look at the example. Here the cross goes with the letter a - actually the cross goes with any letter of the alphabet that stands alone - a, b, c, d, and all of the rest. The two lines go with the letter a with a line through it, and any letter with a line through it - has two lines in front of it. The half-circle goes with the 6 - actually the half-circle goes with any number that stands alone - 6, 7, 1, 3, and the other numbers. The check goes with any number with a line through it.

Look at the column. Here you see numbers and letters - - some stand alone and some with lines through them. Also, they are all mixed up. And there is a blank space before each one. The figure has been left out. Your job is to write in the missing figure. You are to write in the figure that belongs in each blank. Look at the first one. It's a letter standing alone. What figure should be filled in? That's right, the cross. Now - look at the second one. It's a number with a line through it. What figure belongs in the blank? That's right - the check (continue through the column).

So you see - the whole group of letters standing alone - goes with the figure - cross; when you see any letters standing alone, you fill in a cross. The letters with lines through them go with the two lines - whenever you see any letter with a line through it - you fill in two lines (continue these same comments with numbers alone and with numbers crossed out). You may look at the example at the top of the page as often as you need to find out what figures should be in the blank space. (Be sure the subject understands.)

Now turn the page. This page is a lot like the last one. However, here you have more columns which you are to fill the blank spaces in. An many more numbers and letters are used - - and these are all mixed up as far as order goes. However, the line across the top is the same and it tells you what figures go with what groups. The numbers or letters in any group will change - - but the figure that goes with the whole group will stay the same.

__Speed Set__

Now you know what to do. You are to try to get them all right and, one other thing, try to get them all right as quickly as you can. Sometimes your teacher may ask you to work as fast as you can or to do as many problems as you can. Then you try to get all of the problems right as fast as you can; that way you make a better score. Well, that what you are supposed to do with this test. The faster you do them and do them right, the better score you make.

Begin Trial One

Now, let's begin the trial. Fill in the right figures in each blank. You can look at the example at the top of the page as often as you need to. Remember to work as fast as you can and be sure to get them all right.

(At the end of Trial One, say) That trial took you ___ seconds. (Reported time - - attainment time plus 100). Your score was ___ seconds. You got them all right in ___ seconds.

Begin Trial Two

Here is the next trial. Remember, you are to fill in the figures that go in each space. You may look at the line across the top as often as you need to. Remember you are supposed to get all of the problems right as fast as you can. The less time you take, the faster you are, and the faster you do the problems, the better score you get. At the end of Trial Two, repeat the procedure for reporting performance.

Reinforcement Schedule

C6 (D1 and D2) Continue above directions through the 18 trials.
C1 - C5 (D1 and D2) Administer IA directions at the end of Trial Two.
C5 (D1 and D2) Continue speed and accuracy set, IA directions, and reported scores through the 18 trials.
C1 - C4 (D1 and D2) Continue speed and accuracy set and IA directions and administer respective false success and failure reports.

APPENDIX I

MACHINE PROGRAMS UTILIZED FOR THE STATISTICAL ANALYSES[1]

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[1] These programs were developed and written by Richard D. Wilkins, staff member, of the Syracuse University Computing Center.

Bartlett's Test for Homogeneity of Variance[1]

In using the Analysis of Variance technique it is quite important to ensure that the various samples under analysis do not have dissimilar variances. Otherwise, the conclusion drawn from the analysis may be invalid. A quite useful test for this purpose is Bartlett's Test for Homogeneity of Variance for r groups with unequal n's.[2]

For each of the r groups we compute

$$\Sigma x^2 = \Sigma X_i^2 - \frac{(\Sigma X_i)^2}{n}$$ where the X_i are the group data.

The variance for each group is then

$$s^2 = \frac{\Sigma x^2}{n-1} .$$

Under the hypothesis of random sampling from a population or populations with a common variance, the values of s^2 are all estimates of the same parameter. If the hypothesis is true, then these values of s^2 should not differ any more than is to be expected in random sampling from a common population. The test of significance for this hypothesis is made by means of χ^2, and the number of degrees of freedom will be r - 1.

We note that if the number of data for any group is zero or one, that group is degenerate and will be eliminated from the analysis, with the degrees of freedom for the χ^2 being reduced by one. It should also be noted that if a group has more than one data point and a variance of zero, the results of a χ^2 test would be invalid. Random sampling is a basic assumption, but a variance of zero implies that all data points in the group are equal. In a case such as this, the program will bypass the χ^2 test and identify the troublesome groups.

Summarizing the Calculations

1. $\sum_1^r(\Sigma x^2) = a$; $\log_{10} a$

$$\frac{1}{\sum_1^r(n-1)}$$

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[1] Flow sheets and program listings are available at Syracuse University Computing Center, Program Number S. 6.0.501.

[2] Cf. Allen L. Edwards, Experimental Design in Psychological Research (New York: Rinehart & Co., 1956).

2. $[\Sigma(n-1)] \cdot \log_{10} a$

3. $\text{Diff} = [\Sigma(n-1)] \cdot \log_{10} a - \overset{r}{\Sigma}(n-1)\log s^2$

4. $\chi^2 = (\log_e 10) \cdot \text{Diff}$

5. $\text{Correction} = 1 + \left[\frac{1}{3(r-1)}\right] \cdot \left[\Sigma\frac{1}{n-1} - \frac{1}{\Sigma(n-1)}\right]$

6. $\text{Corrected } \chi^2 = \chi^2/\text{Correction}$

The following polynomial is used to compute log X:[1]

Error approximation: .0000,001

If $1 \leq X \leq 10$

$$\overset{*}{\log_{10}}X = \frac{1}{2} + C_1\left(\frac{x-\sqrt{10}}{x+\sqrt{10}}\right) + C_3\left(\frac{x-\sqrt{10}}{x+\sqrt{10}}\right)^3 + \dots + C_9\left(\frac{x-\sqrt{10}}{x+\sqrt{10}}\right)^9$$

$C_1 = .8685,91718$
$C_3 = .2893,35524$
$C_5 = .1775,22071$
$C_7 = .0943,76746$
$C_9 = .1913,37714$

Operating Procedure

A maximum of 498 groups is permitted and an error stop prevents the user from exceeding this. The number of elements in each class is, however, unlimited and null or single element classes are permitted.

A. "650" console settings:

STORAGE ENTRY : 70 1951 8888+
PROGRAMMED : STOP
HALF CYCLE : RUN
ADDRESS SELECTION : IMMATERIAL
CONTROL : RUN
DISPLAY : DISTRIBUTOR
OVERFLOW : STOP
ERROR : STOP

---

[1] Cf. Cecil Hastings, Approximations for Digital Computers (Princeton, N. J.: Rand Corporation, 1955), p. 128, Sheet 4.

B. Control Panel Requirements:

The control panel for the "533" input-output machine is wired to identify load cards specified by a 12-punch in column 1, to read columns 1-80 into the first eight words of any specified read band, and to punch 8 ten-digit words into columns 1-80 from any specified punch band.

C. Program Deck:

The program deck is in the form of 5 per card load cards, with a memory clear card provided as the first card in the deck. The deck need be read in only once even if several Bartlett's Tests are to be run at the same time. After one Bartlett's Test has been completed, the program initializes itself and goes on to the next set of data.

D. Data Card Formats

1. Control Card.--The control card must be the first card in a set of data. Its format is as follows:

Col. 1 : + SIGN (LOAD CARD)
1,2,3,4 : ZEROES
5 : r_1 $1 \leq r_1 \leq 9$ RESTRICTION:
6 : r_2 $1 \leq r_2 \leq 9$ $r = r_1 . r_2 . r_3 . r_4 \leq 500$
7,8 : r_3 $1 \leq r_3 \leq 99$
9,10 : r_4 $1 \leq r_4 \leq 99$
Col. 10 : + SIGN
11-20 : 10 digits of identification
20 : + SIGN

Since this program is primarily designed to be used as an adjunct to an analysis of variance for one through 4 factors, it was arranged to designate a group by stipulating its levels (i,j,k,m) on 4 distinct factors. Thus r_1 is the number of levels of factor 1, r_2 the number of levels for factor 2, etc. If, for example, the user wishes to ignore factors entirely, he may set $r_1 = r_2 = r_3 = 1$ and take r_4 = number of groups ($r_4 < 100$). Other possible combinations should be apparent. We stipulate, however, that in assigning levels, the user proceed consecutively from right to left, setting unused levels equal to one.

As an example, let us look at a generalized two-factor experiment.[1]

---

[1] Cf. Alexander M. Wood, Introduction to the Theory of Statistics (New York: McGraw-Hill Book Co., 1950).

		FACTOR B					
		1	2	3	4	. . . .	c
FACTOR A	1	1,1, 1,1			1,1, 4,2		
	2						
	3						
	4		1,1 2,4				
	⋮						
	r						

In general there will be, say, r nows and c columns for a two-factor experiment, one factor being examined at r levels, $A_1, A_2, \ldots, A_r$ and the other factor B at c levels, $B_1, \ldots, B_C$. Since there are 2 unnecessary factors, we must set $r_1 = r_2 = 1$. We may choose $r_3 = c$, $r_4 = r$ or vice versa. We shall here choose the former. All data in the group under level 1 of FACTOR B and level 1 of FACTOR A would be designated by i,j,k,m = 1,1,1,1 ; the group under level 2 of FACTOR B and level 4 of FACTOR A will be designated 1,1,2,4, etc.

The identification digits are completely arbitrary, dependent only upon the user's requirements. If, however, the user does not need or want any identification, these digit positions may be filled with zeroes or the like.

2. Detail Cards.--(Order is immaterial since each card is self-contained):

Format:

Col. 1 : i $1 \leq i \leq r_1$
2 : j $1 \leq j \leq r_2$
3,4 : k $1 \leq k \leq r_3$
5,6 : m $1 \leq m \leq r_4$
7,8,9,10 : DATA (Sign of DATA in Col. 10)

3. End-of-Data Card.--This card must be the last card in a set of data.

Format:

Col. 1 to 10 : ZEROES
Col. 10 : + SIGN

Error Stops: (These error stops are compatible with the augmented "650.")

9900: One or more of designated levels greater than maximum permitted.

9911: One or more of the factor levels r_i is zero.

9922: One or more of the designated levels i, j, k, m is equal to zero. Check the Control Card: it should be a load card.

9933: Attempting to compute log x, where $x \leq 0$.

9944: Final $\underline{r}$ for χ^2 computation is 0 or 1. This situation may be caused by an excessive number of null, single-point, or zero variance sets.

9966: Somewhere in the calculation, a number in excess of 10 digits has been generated.

9977: All $r_i = 1$.

9988: There is an $r_j = 1$, where $r_i > 1$ and $j > i$. Factor levels must be assigned consecutively from right to left.

9999: The number of groups $\underline{r}$ exceeds the permissible amount (500).

Output Format:

```
  Group       n-1   Σx²    s²    logs²    (n-1) logs²

OxOxOxxOxx     .     .     .       .        .     .
 i j  k  m     .     .     .       .        .     .
    :          .     .     .       .        .     .
    :          .     .     .       .        .     .
    :
χ² value      df
```

The following are 10.0 numbers: n-1, df . Σx^2 is an 8.2 number, while s^2, log s^2, (n-1)log s^2, x^2 are all 6.4 numbers. It will be recalled that:

10.0 number ——————> xxxxxxxxxx.
8.2 number ——————> xxxxxxxx.xx
6.4 number ——————> xxxxxx.xxxx

If a group is null, has a single data point, or has a variance of zero, the corresponding row under n-1 will contain 00000, 11111, or 88888, respectively, and the other columns will be zero. In addition, if any of the groups have a variance of zero, the χ^2 and df will be omitted.

Analysis of Variance for One Through Four Factors[1]

One of the most useful techniques for increasing the sensitivity of an experiment is the designing of the experiment in such a way that the total variation being studied can be separated into components that are of experimental interest or importance. Splitting up the total variation in this manner enables the experimenter to utilize statistical methods to eliminate the effects of certain interfering variables and thus to increase the sensitivity of his experiment. The analysis of variance is a technique for carrying out the analysis of an experiment designed from this point of view.[2]

The program described below is an analysis of variance for factorial experiments of from one through four factors. It may be of value to look at a typical one-factor experiment since higher factor analyses are merely extensions of the same basic theory.

Suppose we have k different groups, with x_{ij} observations under each, with

$$i = 1, 2, \ldots, k \quad \text{and} \quad j = 1, 2, \ldots, n_i$$

allowing for the possibility that there may be different numbers of observations at each level.[3] For example, we may have k different machines which perform a certain production process. It would be desirable to know which is the best machine in terms of production, so an experiment may be designed for which the subject is the number of items produced and the single factor is the type of machine. Observations are taken of production totals for each machine, though we do not assume there will be equal observations on all machines.

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[1] Flow sheets and program listings are available at the Syracuse University Computing Center, Program Number S. 6. 0. 502.

[2] Paul G. Hoel, Introduction to Mathematical Statistics (New York: John Wiley & Sons, Inc., 1954), p. 248.

[3] Alexander McFarlane Mood, Introduction to the Theory of Statistics (New York: McGraw-Hill Book Co., 1950), p. 316.

MACHINE NUMBER				
1	2	3	......	k
X_{11}	X_{21}	X_{31}		X_{k1}
.	.	.		.
.	.	.		.
.	.	.		.
X_{1n_1}	X_{2n_2}	X_{3n_3}		X_{kn_k}

In order to analyze these data, the following assumptions will be made: the n_1 observations for machine 1 constitute a random sample from a normal population with mean ξ_1 and variance σ^2; the observations for the second machine are an independent random sample from a normal population with mean ξ_2 and the same variance σ^2; and similarly for the rest of the machines. The assumptions are thus:

1. The samples are random.
2. The samples are independent.
3. The populations all have the same variance (Cf. Bartlett's Test for Homogeneity of Variance).
4. The populations are normal.

The null hypothesis to be tested is that

$$\xi_1 = \xi_2 = \ldots = \xi_k$$

The average of all the population means is denoted ξ

$$\xi = 1/n \sum_i n_i \xi_i \quad \text{where}$$

$$n = \sum_i n_i \quad \text{and}$$

the deviation of the ξ_i from ξ is denoted α_i.

$$\alpha_i = \xi_i - \xi \; ; \; \Sigma n_i \alpha_i = 0.$$

The α_i are called the effects of the factor; the effects are zero under the null hypothesis.

ANALYSIS OF VARIANCE FOR ONE-FACTOR EXPERIMENTS

Source	Sum of Squares SS	Mean Square MS	Degrees of Freedom	F Ratio
Effects	$\sum_{i=1}^{k}(\overline{x}_i^2) - \frac{\Sigma(\overline{x}_i)^2}{k}$	$\frac{SS}{k-1} = S_1$	k-1	$\frac{S_1}{S_2}$
Deviations	$SS_E \cdot \sum_{i=1}^{k}(\frac{1}{n_i})/k$	$\frac{SS}{n-k} = S_2$	n-k	
Total	$\Sigma X_i^2 - \frac{(\Sigma X_i)^2}{n}$		n-1	

$SS_E = \sum_{i=1}^{k}\left[\Sigma(X_i^2) - \frac{(\Sigma X_i)^2}{n_i}\right]$. The ratio in the right-hand column has the F distribution with k-1 and n-k degrees of freedom under the null hypothesis, $\alpha_i = 0$, and thus provides a test criterion for that hypothesis.

Operating Procedure

A maximum of 298 groups is permitted and an error stop prevents the user from exceeding this. While the number of elements in each class is theoretically unlimited, a null or empty class is invalid and will also result in a machine error stop. It should be noted, however, that methods have been developed which enable the user to fill a null set without thereby affecting the statistical results of the experiment.[1]

A. "650" Console Settings

STORAGE ENTRY : 70 1951 8888+
PROGRAMMED : STOP
HALF CYCLE : RUN
ADDRESS SELECTION : IMMATERIAL
CONTROL : RUN
DISPLAY : DISTRIBUTOR
OVERFLOW : STOP
ERROR : STOP

B. Control Panel Requirements

The control panel for the "533" input-output machine is wired to identify load cards specified by a 12-punch in column 1, to read columns 1-80 into the first eight words of any specified read band, and to punch 8 ten-digit words into columns 1-80 from any specified punch band.

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[1] William G. Cochran & Gertrude M. Cox, Experimental Designs (New York: John Wiley & Sons, Inc, 1957), p.80.

C. Program Deck

The program deck is in the form of 5 (and some 2) per card load cards, with a memory clear card provided as the first card in the deck. The deck need be read in only once even if several analyses of variance are to be run at the same time. After one analysis of variance has been completed, the program initializes itself and goes on to the next set of data.

D. Data Card Formats

1. Control Card.--The control card must be the first card in a set of data. Its format is as follows:

Col. 1 : + SIGN (LOAD CARD)
1,2,3,4 : ZEROES
5 : r_1 $1 \leq r_1 \leq 9$ Restriction:
6 : r_2 $1 \leq r_2 \leq 9$ $r = r_1, r_2, r_3, r_4 \leq 300$
7,8 : r_3 $1 \leq r_3 \leq 99$
9,10 : r_4 $1 \leq r_4 \leq 99$
Col. 10 : + SIGN
11-20 : 10 digits of identification
20 : SIGN

It was arranged to designate a group by stipulating its levels (i,j,k,m) on 4 distinct factors. Thus r_1 is the number of levels of factor 1, r_2 the number of levels for factor 2, etc. If, for example, the user wishes to ignore factors entirely, he may set $r_1 = r_2 = r_3 = 1$ and take r_4 = number of groups ($r_4 < 100$). Other possible combinations should be apparent. We stipulate, however, that in assigning levels, the user proceed consecutively from right to left, setting unused levels equal to one.

As an example, let us look at a generalized two-factor experiment.[1]

		FACTOR B					
		1	2	3	4	. . .	c
FACTOR A	1	1,1,1,1			1,1,4,2		
	2						
	3						
	4		1,1 2,4				
	⋮						
	r						

---

[1] Mood, op. cit., p. 330.

In general there will be, say, r rows and c columns for a two-factor experiment, one factor being examined at r levels, A_1, A_2, . . . , A_r and the other factor B at c levels, B_1, . . . , B_c. Since there are two extraneous factors, we must set $r_1 = r_2 = 1$. We may choose $r_3 = c$, $r_4 = r$ or vice-versa. We shall here choose the former. All data in the group under level 1 of factor B and level 1 of Factor A would be designated by i,j,k,m = 1,1,1,1 . The group under level 2 of factor B and level 4 of factor A will be designated 1,1,2,4, etc.

The identification digits are completely arbitrary, dependent only on the user's requirements. If, however, the user does not need or want any identification, these digit positions may be filled with zeroes or the like.

2. Detail Cards.--(Order is immaterial since each card is self-contained).

Format:

Col. 1 : i $1 \leq i \leq r_1$
2 : j $1 \leq j \leq r_2$
3,4 : k $1 \leq k \leq r_3$
5,6 : m $1 \leq m \leq r_4$
7,8,9,10 : DATA (sign of DATA in Col. 10)

3. End-of-Data Card.--This card must be the last card in a set of data.

Format:

Col. 1 to 10 : ZEROES
Col. 10 : + SIGN
Col. 11 - 20 : BRANCH NUMBER
20 : + SIGN

If the branch number is non-zero, the group means and the number of data in each group will be punched after the standard analysis of variance table; if the branch number is zero, the program will only compute the analysis of variance table. This punch-out routine begins at location 1700. If the means are punched, identification is provided by stipulating the corresponding levels of the various factors: i,j,k,m.

Error Stops: (These error stops are compatible with the augmented "650.")

9900: One or more of the designated levels, i,j,k, m greater than maximum permitted.

9911: One or more of the factor levels r_i is zero.

9922: One or more of the designated levels i,j,k,m is equal to zero. Check the control card: it should be a load card.

9955: A group has $n_i = 0$. The problem may be obviated, however. Cf. footnote 1, p. 351.

9966: Somewhere in the calculation, a number in excess of 10 digits has been generated. Perhaps the size of the individual datum is causing this problem. If this is the case, the user may be able to eliminate the problem by performing "a linear adjustment of the data" i.e., division of the data by a constant or subtraction from the original data of a constant.

9977: All $r_i = 1$.

9988: There is an $r_j = 1$, where $r_i > 1$ and $j > i$. Factor levels must be assigned consecutively from right to left, i.e., for a two-factor analysis, $r_1 = r_2 = 1$.

9999: The number of groups r exceeds the permissible amount (300). If an error stop occurs, the program deck should be reloaded before continuing.

If either the identification material on the control card or the branch number on the end-of-data card are omitted, a distributor validity error will occur. If the identification material is missing, the user, if he desires the identification material, can manually read it into 1952 and manually transfer to 1159, or he may correct the erroneous card and reread it with its data set by simply manually transferring to 1500, the beginning of the program; the program deck need not be reread. If the identification is nonessential, a manual transfer to 1500 will continue the program without error. If the branch number is missing, the user will manually transfer to 1700 if he desires the means and to 1500 if other sets of data remain to be analyzed. After punching the means, the program automatically proceeds to the remaining data sets. If an erroneous data card results in a distributor validity check, the card may be corrected, reinserted in the read hopper, and the program continued by a manual transfer to 1500. The program deck need not be reloaded.

Output Format:

A sample of the output format for 1 and 4 factor analyses appears on the next page. It will be noted that only in the case of a 4 factor analysis will all 15 identification symbols be used; a 1 factor analysis will use only (1); a 2 factor analysis will use 1, 2 and 1020. The df and the n_i values, if given, are 10.0 numbers, while SS, MS, F values, Deviations, SS_T and means $\overline{X}_i$, when given, are 8.2 numbers, where a 10.0 number is of the form xxxxxxxxxx.

and an

8.2 number is of the form xxxxxxxx.xx

If the n_i for each group are equal, then

$SS_T = \Sigma SS_C$ where SS_C represent the preceding entries in the SS column including SS deviations.

If the n_i are not equal, a series of 9's will be punched in the MS column of Totals (normally empty) to indicate this. It will be noted further that df for Totals is N - 1 where N is the total number of data read. Similarly df (deviation) = N - 1 - Σdf_C where df_C are the preceding df's in the column. Should "Deviations" turn out to be zero, a series of 9's will be punched in the positions normally occupied by the F ratios.

In testing for significance, df Deviations will always be considered as the denominator, while the df of the effect or interaction being tested will be the numerator.

The means of all cells, X_i, together with n_i and identification i,j,k,m are punched provided the branch number is not zero.

Locations 0000 through 954 are reserved for storage of various data:

0000 ⟶ 0299 max: ΣX_i
0300 ⟶ 0599 max: ΣX_i^2
0600 ⟶ 0899 max: N_i
0900 ⟶ 0916 : Source Identification Numbers
0917 ⟶ 0933 : SS from A through Deviations and Totals
0934 ⟶ 0950 : df from A through Deviations and Totals
0951 ⟶ r_1 (10.0) number
0952 ⟶ r_2 " "
0953 ⟶ r_3 " "
0954 ⟶ r_4 " "

ONE FACTOR ANALYSIS

Identification
2066110031

	SS	MS	df	F	
Effects 1	4.05	1.35	3.	1.53	
Deviations	14.99	.88	17.		$F_{\%}$ (3,48) level
11111111 SS_T	24.24	99999999	20.		
i j k m	$\overline{x}_i$	n_i			
101001001	6.00	4.			
101001002	5.25	4.			
101001003	8.00	7.			
101001004	6.33	6.		$r_1 = r_2 = r_3 = 1; r_4 = 4$	

FOUR FACTOR ANALYSIS

Identification
5555555555

		SS	MS	df	F
A	1	884.77	442.39	2.	90.28
B	2	9.52	9.52	1.	1.94
C	3	61.25	12.25	5.	2.50
D	4	945.01	315.00	3.	64.29
AxB	1020	13.51	6.76	2.	1.38
AxC	1030	115.33	11.53	10.	2.35
AxD	1040	36.58	6.10	6.	1.24
BxC	2030	43.86	8.77	5.	1.79
BxD	2040	3.15	1.05	3.	.21
CxD	3040	20.69	1.38	15.	.28
AxBxC	102030	162.29	16.23	10.	3.31
AxBxD	102040	1.77	.30	6.	.06
AxCxD	103040	28.00	.93	30.	.19
BxCxD	203040	8.91	.59	15.	.12
AxBxCxD	10203040	38.44	1.28	30.	.26
Deviations		4,941.18	4.90	1,008.	
11111111 SS_T		7,314.48		1,151.	

APPENDIX J

CODE NUMBERS OF SUBJECTS EMPLOYED IN THE ANALYSIS OF PSYCHOMETRIC TEST PERFORMANCE AND OF ACHIEVEMENT TEST PERFORMANCE

A. CODE NUMBERS OF SUBJECTS EMPLOYED IN THE ANALYSIS OF PSYCHOMETRIC TEST PERFORMANCE

B1-2
B1-8
B1-13
B1-16
B1-17
B1-18
B1-23
B1-27
B1-28
B1-31
B1-33
B1-39
B1-43
B1-44
B1-51
B1-52
B1-53
B1-55
B1-58
B1-59
B1-61
B1-62
B1-64
B1-68
B1-72
B1-73
B1-74
B1-75
B1-78
B1-79
B1-80
B1-81
B1-86
B1-87
B1-89
B1-91
B1-96
B1-97
B1-98
B1-101
B1-105
B1-108
B1-110
B1-114
B1-116
B1-118
B1-119
B1-120
B1-124
B1-126
B1-127
B1-131
B1-133
B1-135
B1-138
B1-142
B1-144
B1-151[a]
B1-153[a]
B1-154

B2-3
B2-4
B2-5
B2-6
B2-8
B2-9
B2-11
B2-14
B2-15
B2-17
B2-20
B2-21
B2-23
B2-24
B2-25
B2-26
B2-27
B2-28
B2-29
B2-35
B2-36
B2-38
B2-39
B2-41
B2-45
B2-47
B2-48
B2-50
B2-52
B2-53
B2-54
B2-55
B2-56
B2-57
B2-59
B2-60
B2-62
B2-63
B2-65
B2-66
B2-67
B2-68
B2-69
B2-72
B2-75
B2-76
B2-77
B2-80
B2-83
B2-84
B2-85
B2-87
B2-88
B2-89
B2-90
B2-91
B2-92
B2-96
B2-98
B2-100

B3-1
B3-3
B3-7
B3-8
B3-9
B3-10
B3-11
B3-17
B3-18
B3-21
B3-22
B3-23
B3-24
B3-26
B3-27
B3-28
B3-29
B3-30
B3-31
B3-33
B3-34
B3-35
B3-36
B3-37
B3-38
B3-40
B3-42
B3-45
B3-46
B3-47
B3-49
B3-50
B3-55
B3-56
B3-57
B3-59
B3-60
B3-62
B3-64
B3-65
B3-67
B3-68
B3-69
B3-70
B3-71
B3-72
B3-73
B3-76
B3-78
B3-79
B3-81
B3-83
B3-89
B3-90
B3-92
B3-93
B3-94
B3-98
B3-99
B3-101[a]

---

[a] A substitution after list in Appendix A was prepared.

B. CODE NUMBERS OF SUBJECTS EMPLOYED IN THE ANALYSIS OF ACHIEVEMENT TEST PERFORMANCE

B1-1
B1-2
B1-5
B1-7
B1-8
B1-13
B1-14
B1-15
B1-16
B1-17
B1-21
B1-23
B1-24
B1-25
B1-26
B1-27
B1-28
B1-29
B1-30
B1-33
B1-34
B1-35
B1-39
B1-40
B1-42
B1-43
B1-44
B1-47
B1-51
B1-53
B1-54
B1-58
B1-59
B1-60[a]
B1-61
B1-62
B1-66
B1-68
B1-70
B1-72
B1-73
B1-75
B1-76
B1-78
B1-79
B1-80
B1-81
B1-83
B1-87
B1-89
B1-90
B1-96
B1-97
B1-98
B1-100
B1-101
B1-106
B1-108
B1-110
B1-111
B1-114
B1-116
B1-117[a]
B1-118
B1-119
B1-120
B1-123
B1-126
B1-127
B1-128
B1-130
B1-131
B1-133
B1-135
B1-138
B1-139
B1-142
B1-144
B1-151[a]
B1-154

B2-3
B2-4
B2-5
B2-6
B2-8
B2-9
B2-11
B2-13
B2-14
B2-15
B2-16
B2-17
B2-19
B2-21
B2-22
B2-23
B2-24
B2-25
B2-26
B2-27
B2-29
B2-30
B2-31
B2-33
B2-34
B2-36
B2-37
B2-38
B2-39
B2-40
B2-41
B2-44
B2-45
B2-46
B2-48
B2-49
B2-50
B2-51
B2-52
B2-53
B2-54
B2-55
B2-56
B2-57
B2-58
B2-59
B2-60
B2-62
B2-63
B2-64
B2-65
B2-66
B2-67
B2-68
B2-69
B2-70
B2-71
B2-72
B2-73
B2-75
B2-76
B2-77
B2-78
B2-79
B2-80
B2-82
B2-83
B2-84
B2-85
B2-87
B2-88
B2-89
B2-90
B2-91
B2-92
B2-94
B2-96
B2-97
B2-98
B2-100

B3-1
B3-2
B3-3
B3-5
B3-6
B3-7
B3-8
B3-9
B3-10
B3-11
B3-13
B3-14
B3-15
B3-16
B3-17
B3-18
B3-20
B3-22
B3-23
B3-26
B3-27
B3-28
B3-29
B3-30
B3-31
B3-33
B3-34
B3-35
B3-36
B3-37
B3-42
B3-44
B3-45
B3-46
B3-47
B3-48
B3-50
B3-51
B3-53
B3-54
B3-55
B3-56
B3-57
B3-58
B3-59
B3-60
B3-61
B3-62
B3-64
B3-65
B3-66
B3-67
B3-69
B3-71
B3-73
B3-74
B3-75
B3-76
B3-77
B3-78
B3-79
B3-80
B3-81
B3-82
B3-83
B3-85
B3-86
B3-87
B3-89
B3-90
B3-91
B3-92
B3-93
B3-95
B3-96
B3-97
B3-98
B3-102[a]
B3-103
B3-104[a]

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[a] A substitution after list in Appendix A was prepared.